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Organisational change associated with introduction of an electronic health record in residential aged care homes

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ORGANISATIONAL CHANGE ASSOCIATED WITH INTRODUCTION OF AN ELECTRONIC HEALTH RECORD IN RESIDENTIAL AGED CARE HOMES

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ABSTRACT

Since the turn of the century, many residential aged care homes in Australia have made the transition from paper-based documentation to computer-based health records. This thesis explores issues pertaining to organisational change associated with this process based on longitudinal interviews with care staff in three residential aged care homes under the same management group over an eighteen month period during and after the system's introduction.

There is an expansive theoretical and empirical literature on organisational change in the organisational studies literature. However research on organisational change in health informatics has been limited, although researchers acknowledge its importance. Most evaluation research in health informatics takes a hypothetico-deductive (positivist, statistical) approach to developing research problems, and reaching conclusions. However in organisational studies, an exploratory, narrative based approach to understanding organisational change is a more frequent approach. This approach emphasises understanding multiple competing points of view within an organisation, and mapping these to key events and outcomes related to the research situation. This approach has been in health informatics used in large scale summative capstone research of a national e-health implementation, and as a single case study as part of a theoretical paper.

This thesis presents a case study using a heuristic approach to reasoning to bear on a meso-scale healthcare environment studying an organisation which provides up to approximately fifteen percent of the residential aged care service in the regions which it operates in. The goal of the research was to understand the context of these homes' operations, what and how the successful outcomes occurred, whether these outcomes were sensitive to the initial conditions at each aged care home; how staff affected by the introduction of the electronic health record, and how the staff perceived the introduction of the software.

Chapter one of the thesis introduces the research problem space, and the research questions to be answered. Chapter two provides broader academic and industry context, examining key literature concerning organisational change and existing evaluation work on electronic nursing documentation, and our knowledge of computer usage in nursing and aged care. Chapter three details the methods used to collect and analyse the research data. Chapter four presents basic demographic information, as well as interpretive research results related to staff demographics. Chapter five provides a detailed description of the key stakeholders encountered in the research. The research was conducted mainly from the perspective of internal stakeholders, however

this chapter also discusses the regulatory environment. Chapter six discusses care staff's experience with the electronic health record, in particular examining their positive and negative experiences with the software. Finally chapter seven discusses the impact of the electronic health record on the provision of care.

The final chapter concludes by presenting a summary of findings expressed in terms of the research questions presented in chapter one. The major benefits encountered were related to a much better computer-assisted funding process. This outcome was easily achieved at each site, and beyond ensuring adequate information technology hardware at each site seemed to pose few management challenges. Encouraging appropriate usage of the electronic health record by all staff was a challenge, which I conclude could be addressed by managers ensuring that they take account of the multiple competing points of view of the nature of nursing work and the role of electronic documentation for site managers and care staff.

KEYWORDS: Organisational change, interpretive research, health informatics, aged care, electronic health records

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Acronyms

ACFI Aged Care Funding Instrument. 92, 98, 101, 132, 143, 152, 153, 156, 165, 195

ADSL Assymetric Digital Subscriber Line. 87

ARC Australian Research Council. 1

CEO Chief Executive Officer. 84–87, 94, 96

CFO Chief Financial Officer. 86

CPOE Computerised Provider Entry System. 6, 28

DRSM Deputy Residential Services Manager. 57, 62, 63, 66, 70, 88, 89, 99–101, 106, 111, 115, 116, 118, 122, 134, 137, 143, 145, 146, 155–157, 168, 169, 172, 173, 182, 183, 185

EFT Electronic Funds Transfer. 144

EN Enrolled Nurse. 57, 63, 74, 76, 88, 90, 99, 102, 148, 149, 151, 153, 154

ENCP Electronic Nursing Care Plans. 32

END Electronic Nursing Documentation. 1–5, 7, 8, 10, 12, 14, 16, 23, 32, 38, 40, 47, 48, 63, 65, 66, 74, 76, 77, 79, 80, 82–85, 88–90, 93–96, 98, 100, 102, 106–108, 110, 111, 113–124, 126–128, 130, 132–140, 142–150, 152, 153, 155–157, 159–164, 166, 167, 169–195, 197

GP General Practitioner. 167, 169, 170, 172, 173

IE Institutional Ethnography. 52–54

IS Information Systems. 2, 5, 9, 58

IT information technology. 5, 6, 9, 11, 12, 17, 18, 20, 27, 30, 32, 36, 37, 40, 49, 76, 80, 84, 87, 105, 106, 115, 118, 119, 135, 137, 138, 183, 184, 188, 192

LCTL Low Care Team Leader. 57, 62, 88–90, 92, 99–101, 105, 116, 132, 145, 151–154, 157, 163, 165, 170, 174, 175, 189

NHS National Health Service. 6, 11, 12

PCW Personal Care Worker. 57, 63, 65, 66, 70, 72, 74–77, 80, 82, 89, 91, 92, 97, 102, 103, 109, 110, 114, 120, 126–129, 133–135, 148–150, 152, 153, 155, 156, 158–162, 170–172, 174, 179, 184, 187–189

RACH Residential Aged Care Home. 1, 4, 5, 7, 11–13, 18–20, 24–26, 32, 35, 55, 56, 59, 66, 71, 74–77, 80, 82–85, 88, 90, 91, 93, 95–97, 100, 107, 111, 115, 119, 120, 133, 134, 136, 144, 167–169, 172–174, 177, 179, 181, 186, 187, 189, 191–196

RAO Recreational Activities Officer. 70, 77, 179, 190, 191

RCS Resident Classification Scheme. 92, 153

RN Registered Nurse. 57, 61, 63, 66, 72, 74, 76, 77, 88–92, 99, 101, 102, 118, 122, 124, 128, 134, 138, 148, 149, 151–159, 161, 164, 170, 171, 173, 174, 180, 189, 190

RSM Residential Services Manager. 57, 62, 63, 66, 70, 79, 88–90, 98, 99, 101, 109, 116–118, 137, 138, 146, 147, 150, 152, 163, 171, 182, 185

TAFE Technical and Further Education. 90

TTT Train the Trainer. 82, 102–106, 109, 112, 183

XML Extensible Markup Language. 144

Chapter 1

Introduction

The research reported in this thesis examined the organisational impact of implementing an Electronic Nursing Documentation (END) system in Residential Aged Care Homes (RACHs) over a period of eighteen months. Longitudinal data was collected by interviewing a cross section of care staff and managers at three RACHs under the same management group. This introduction outlines the research setting, and research questions, followed by an outline of the data collection methods used, the expected contribution of this research to managing the introduction of END field, and the structure of the rest of this thesis.

This research was conducted as part of an Australian Research Council (ARC) linkage grant - "Introducing computer-based nursing documentation into residential aged care: A multi-method evaluation of success" (Yu & Hailey, 2008). It is part of a multi-strand research project that ran between 2008 and 2011. There were three other concurrent components of this project. The first was questionnaire research conducted

by the grant holder (Ping Yu, my primary PhD supervisor), examining the outcome of implementation of the END based on a variety of Information Systems (IS) success models (e.g. Yu, Li & Gagnon, 2009). The second was a PhD project understanding care-givers' time usage pre-and-post implementation of the documentation system (e.g. Munyisia, Yu & Hailey, 2011c) using work sampling techniques (a technique used to estimate the kind of data produced in a time and motion study). The third examined the effects of the electronic documentation system on documentation quality (i.e. a sub-project with a clinical nursing focus) by developing an instrument to assess documentation quality and comparing this pre- and post- implementation of the END (e.g. Wang, Hailey & Yu, 2011). The research presented in this thesis complements the other strands of this programme by being a detailed examination of the content, context and process of the implementation of the electronic health record. This approach defines my research as process based research. Process based research and how it can provide a better understanding of the process and context of the evaluation of the END introduction is discussed in chapter 2.

The course of a qualitative research project in the social sciences is always influenced by the experiences and background of the person conducting the research (Breuer, 2003). Similarly the concept of organisational change has "almost as many definitions as it has practitioners" (Pettigrew, 1985, p. 3). Thus in setting the scene for this study, a brief outline of my background is useful. My first degree was in psychology. By my honours year I had developed an interest in cognitive neuroscience and neuropsychology. My first job after my degree was as an assistant in nursing in

inpatient adult acute psychiatry. That experience gave me familiarity with the structure, culture and general nature of nursing work. My experience was in mental health nursing with little involvement in the physical aspects of the job. Nursing for physical care is the stock in trade of aged care nurses, so my experience was substantially different from the people I was interviewing for my PhD research. From there I went on to do psychological assessment and research in neurorehabilitation. In the next stage of my career I became involved in academic research in innovation and knowledge management. During this period I also developed some skills as a software developer specialising in data modeling, text processing and programming for the World Wide Web. Thus range of experiences broadly informed my approach to framing and resolving my research. My healthcare work (along with some formative experiences as a child) gave me experiences interacting with people from a very wide range of social backgrounds and experience. My education in psychology informed my understanding of the scientific method, and its limitations. My background as a software developer gave me an appreciation of what is possible with information technology – especially concerning what it is easy and difficult to achieve from a technical perspective.

The aim of this research was to use coherent and logically sound methods in order to understand and explain the organisational changes associated with introduction of the END. My perspective was one of 'breadth first'. That is rather than directly examining the management issues associated with the introduction, to focus on understanding the changes associated with the introduction from as many relevant perspectives as possible. In other words I tried to give equal weight to the views of all staff, junior as

well as senior. Thus the research questions given below are general and apply to all staff, not just to the perspective of the managers in the organisation.

The research questions are centred around a process based view of organisational change in that the goal of the research is to describe how the changes caused by the END implementation "emerge, develop, grow or terminate over time" (Van de Ven, 2007, p. 21). In the case of this research the temporal component is supplied by the concepts of "implementation" (as an on-going activity) and "outcome" (as a destination) of the implementation of the END. My specific research questions are :

- What are the contextual factors that surround the implementation of the END?
- How do these factors influence a successful outcome of the implementation and what is their magnitude?
- Does the context create a sensitivity to initial condition causing a difference between sites? If so, how? Are different parts of the implementation more sensitive than others?
- How do staff at different levels of the organisation perceive the outcome of the implementation of the END? Which outcomes are perceived similarly? Which outcomes are perceived differently?

Data collection for my research was mainly conducted largely at two RACHs under the same management group, one in a regional location in South Eastern New South Wales, Australia, and the second at a rural location around 100km away from

the regional site. Most of the data collected was based on transcripts of interviews with care staff and managers. At these two sites, interviews were conducted at pre-implementation of the END, then 6 months and 12 months post-implementation. A third site from the same management group that had already implemented the END system prior to the commencement of the research was also included. Interviews at this site occurred at 12 months, 18 months and 30 months post-implementation. This location was included as a green field site, without a prior paper-based documentation system.

During the early stages of data collection, an ethnographic/participant-observation approach was suggested, but discounted due to a perceived potential for workplace disruption in a working environment where resource constraints (including frequent staff shortages) are acute. Although the initial interviews were conducted based on the reformulated DeLone and McLean's IS success model (DeLone & McLean, 2003), over the course of the research project modifications were made to the interview guide in order to better understand the journey each RACH took towards the eventual outcome of the implementation of the END.

Published research investigating the process of implementation of health information technology (IT) projects from an organisational perspective is sparse, although not entirely absent. Lorenzi and Riley (2000) argued that investigating the people and organisational impacts of the medical informatics literature was a developing field with interdisciplinary antecedents in "psychology, sociology, social psychology, social anthropology, organisational behaviour, organisational development, management and

cognitive sciences". Lorenzi and Rilley's subsequent writing (Lorenzi & Riley, 2002; Lorenzi & Riley, 2003) has provided more specific suggestions with respect to studying and understanding organisational issues surrounding health informatics implementations. These issues, and an approach to studying them are outlined in the second half of chapter 2.

With respect to empirical research conducted in the field, interpretive studies often used in organisational change research typical in the field of organisational studies (see Weick & Quinn, 1999, for a review) are rare in the field of health informatics. There has been some research of this type in the area of hospital based Computerised Provider Entry System (CPOE) systems - computer directed systems for managing patient treatment generally with a particular focus on drug treatments. However there is only a limited amount of relatively open-ended socially-focused, exploratory, interpretive research typified by much work in organisational studies. Nonetheless the awareness of the importance of these issues does seem to be increasing among health IT researchers and practitioners. One contribution resulted from difficulties surrounding the implementation of information systems in the British National Health Service (NHS) (Sheikh et al., 2011). Patricia Greenhalgh's research team has published detailed micro-level case studies examining some of the social issues surrounding the health IT issues. In particular, problems in the NHS implementation, as well as broader theoretical explanations of why and how such context and process focused accounts of implementations are important (Greenhalgh & Russell, 2010; Greenhalgh, Russell, Ashcroft & Parsons, 2011). My research is strongly influenced by the approach

of Greenhalgh's research group.

Although somewhat similar work to mine has been done in hospital settings as part of two other PhDs (Engesmo, 2008; Swinderman, 2005), both Engesmo's and Swinderman's projects were participative inpatient hospital based research primarily based on the manager's perspective and concerning a restricted range of the organisations' function. By comparison the present study uses an observational approach and is concerned with the entire scope of the care work in RACHs, including all relevant staff members from senior managers to junior personal care workers. The data collected for my research also distinguishes itself by being a longitudinal, prospective study with a relatively large sample size in comparison with other qualitative work in health informatics. Much contextualist, process based research is based on participative methods. However clinical healthcare environments, and RACHs are busy, high work-intensity environments. Therefore the perceived or actual difficulties of performing full-immersion research in these situations make using participant-observation methods difficult because of the perceived potential for disruption in the workplace. Given the difficulties experienced in the health industry as a whole with implementing electronic health records (Sheikh et al., 2011; United States Institute of Medicine, 1997), one contribution of my research is to help managers and implementers understand what and how to examine the trajectory of the introduction of ENDs.

Chapter 2 is divided into two sections. In the first section we frame this gap in the literature by examining published research on electronic nursing documentation, identifying what work with an organisational focus has already been done and the

need for my research project in that context. In the second section I examine the theoretical approaches to organisational change management that have already been highlighted in the literature, and provide an evaluation of this theory to date in order to fully frame the approach to my study. After that, given that the initial brief for the project was that the data collection was to be based primarily on interviews, chapter 3 outlines the methods used to collect and analyse the interview data, and chapter 4 to chapter 7 examine different aspects of the results as follows:

- Chapter 4 (p 66): Basic demographics, and the role of computers in participants' life.
- Chapter 5 (p 83): Description of the stakeholders and main contexts in which the research took place.
- Chapter 6 (p 114): Participants' experiences with using the END.
- Chapter 7 (p 142): Impacts on work practices, care impacts and changes in relationships with external stakeholders.
- Chapter 8 (p 178): Recommendations and conclusions.

1.0.0.1 How to read this thesis

While this thesis is structured to be read in sequential order, this document contains numerous cross-references, to enable the work to be read in the order found most suitable. If reading electronically as a PDF, all cross references, acronyms and citations

are hyperlinked in the text. I hope is that this work will be viewed as a simple contribution to the nascent field of hypertext ethnography (Mason & Dicks, 2001).

Chapter 2

Background to research

The successes and failures of implementation of information systems in health care are not primarily due to technical factors. Organisational, interpersonal and other social issues are also at least as important (e.g. Lorenzi, Mantel & Riley, 1990; Greenhalgh et al., 2011). Because of the increasing penetration into work, including health care, Information Systems (IS) now affect more heterogeneous groups of individuals than they did during the early health information technology (IT) implementations (Lorenzi & Riley, 2003). Thus the organisational changes caused by the introduction of health IT are occurring to an increasingly diverse pool of stakeholders with different perceptions.

The study of nursing informatics is a relatively new area of research. It began in the mid 1990s (e.g. Saba & McCormick, 1995). The phrase electronic nursing documentation first appeared in the literature in around the year 1998 (e.g. Bürkle, Michel, Horch, Schleifenbaum & Dudeck, 1998). Organisation studies form a research

area with a much longer history. The scientific management movement for example dates from 1914 (Taylor, 1914). The purpose of this chapter is to better understand the relationship between these two fields, in order to discover the constructs used in prior relevant organisational research, and apply it to better understanding the issues of organisational change arising from the introduction of Electronic Nursing Documentation (END).

"Engaged Research" developed by Andrew Van de Ven over the course of his career (Van de Ven, 2007) is one approach to investigating a diverse range of perceptions in an academic context. This approach provides the framework for analysing organisational change. The framework is geared to *situating*, *grounding*, *diagnosing* and *resolving* organisational research problems described in more detail below.

After a discussion of the engaged research approach, the published literature on academic, occupational and technological facets of electronic nursing documentation and organisational studies in health informatics is reviewed. The academic literature on computer usage within aged care specifically is also reviewed.

2.1 Contextualising, grounding and situating the research

- Context – Situating 1: The history of computer usage in the nursing profession.

The extent of the usage of computers in nursing generally, and in aged care nursing is a required context for understanding the research situation. How nurses use com-

puters, how long they have been using them for, how many of their peers have been using computers, and the nature of that usage are important factors to understand for this research. The discussion presented in this section finishes with an examination of the academic literature on computer usage in a specific nursing context, aged care.

- Context – Situating 2: Organisational structure in health care and in the Residential Aged Care Home (RACH)

Health care organisations are different and more complex than most, if not all manufacturing organisations where much research on organisational change has occurred. Consideration of how and why this complexity affects the implementation of software systems in the organisation is thus also important.

- Grounding 1: Prior research on electronic nursing documentation

My research has not been performed in isolation, or in a new academic field. This section provides an overview of prior research on electronic nursing documentation in the field of health informatics, with a particular emphasis on organisational issues. There is relatively little work on electronic nursing documentation in health informatics, and few publications on organisational aspects of informatics in nursing.

- Grounding 2: Organisational research in health informatics as a whole

  This section discusses some of the prior foundational work in this area.

- Diagnosis : Reflections on results of interpretive work in health informatics arising from the British National Health Service (NHS) e-health IT implementations.

Section 2.7 discusses two research papers on the British NHS health IT programme. The first is a large scale summative analysis of the four national implementations (England, Scotland, Wales and Northern Ireland) (Greenhalgh, Morris, Wyatt, Thomas & Gunning, 2013). The second paper is a smaller scale single case study of a local health IT champion in the context of the English implementation of an electronic health record. As well as providing an overview of these two papers, Greenhalgh et al. (2011) explore an approach for drawing conclusions from case study data known as 'heuristic generalisation'. This is distinct from the quasi-experimental approach common in health informatics research (Harris et al., 2006) using inductive generalisation. Section 2.7.1.1 provides a definition of what is meant by 'heuristic' in this context.

2.2 Research philosophy – "Engaged Research"

Van de Ven's Engaged Research (Van de Ven, 2007) approach to organisational change research provides a framework for formulating relevant research questions. At its core the engaged research approach requires "situating, grounding, diagnosing and resolving a research problem" (Van de Ven, 2007, p. 85). Van de Ven defines a research problem as "any problematic situation, phenomenon, issue, or topic that is chosen as the subject of an investigation". In my study that is the organisational change associated with the introduction of an END system in RACHs.

2.2.1 Situating, grounding, diagnosing, and resolving the research questions

This research was conducted in three different RACHs run by the same management group. The method was based on extended interviews of staff working inside these RACHs. Supplementary data were collected during secondary data collection activities at another three RACHs within the same management group, and at one RACH under a different, larger management group. In addition interactions at industry and academic conferences in nursing, health informatics, information systems, and ageing research provided additional information to assist my interpretation of the data. Other information on situation/context was from key external stakeholders associated with the RACHs under study actively involved in aged care. Analysis of the perspectives of various stakeholders is detailed in chapter 5.

My research was grounded in the computing environment prevalent throughout the years that data collection was conducted between 2008 and 2010. Then, the desktop personal computer was still people's the main way of interacting with computers, either at work or home. Touch screen devices are now widely used in were in a very early stage of development. The first iPhone was released six months before I began this research, before which there were no alternative devices of similar capability. Touchscreen tablet devices were generally modified Windows computers with stylus inputs with difficult to use interfaces in the context of handheld devices. Tablets with intuitive multi-touch user interfaces were not commercially available. Nurses' use of computers for work is

covered in detail in section 2.3.

While typical expected reactions to change were investigated (e.g. resistance to change), this research is more concerned with ways that users of the END reacted to and adapted to its introduction. It was concerned with understanding the trajectory of the implementation at the different homes, especially with respect to the similarities and differences of stakeholders' perspectives, rather than examining how users adapt to specific problems, or benefits.

Answering the research questions is done by generating a narrative account of the implementation. This narrative which accounts for the bulk of this document is based on a systematic analysis of interview transcripts. Methodology is described in chapter 3 and analysis of these interviews is presented in chapters four to seven.

Van de Ven and Poole's (Van de Ven & Poole, 2005) paper on methods to study organisational change presents a means to identify suitable methods for addressing particular research problems – i.e. the context of my research project. This comprises two distinct epistemologies (theories of knowledge, especially with regards to methods, validity, scope and the disjunction between justified belief and opinion) for studying change, and two different ontologies (i.e. sets of concepts and categories that describe the properties of concepts and the relations between them). The two epistemologies are a variance (quantitative) approach, and a process (qualitative) approach. The ontologies are: the organisation as a "real" entity – fixed in its environment, and an emergent process that changes over time in an "emergent flux". These correspond to the organisation understood as a noun – thus a 'thing', and the organisation as a verb

– the activities of the entity, not the entity itself that describes the activity of the organisation understood as the totality of its activities and interactions.

The variance approach is concerned with the quantification of variables. Research designs manipulating independent variables in quasi-experimental or natural experiment systems illustrate this type of research when the organisation is considered a fixed entity. This is the most common mode of research in health informatics evaluations, for example with questionnaire data. When the organisation is considered as activity, and the epistemological approach is the variance type, research designs are based on dynamic modelling. This approach lends itself to simulation research. While simulation is a relatively popular approach in the social sciences (e.g. Gilbert & Troitzsch, 2005), it is a distinct and separate research approach than that presented here.

Process approaches concern the use of narrative as an analytic technique. When the organisation is considered as a thing, the primary concerns include how sequences of events unfold, and whether change processes enter stages or cycles during the development of the change.

When the organisation is considered as activity, the main concerns include how the organisational actors' responses emerge, and how those responses evolve over time. Greenhalgh's approach (Greenhalgh & Russell, 2010; Greenhalgh et al., 2011) exemplifies the use of process/activity organisational research in health informatics.

Although cycles of change, and the sequence of events are important in my research context, my study was conducted from an individual perspective. This was in order

to understand better the stakeholder's response to the introduction of the END, and the impacts on daily work and organisational activities that emerge from the change. The focus of interviews was on the workplace, and the work activity impacts of the new documentation system.

Van de Ven and Poole's classification of different types of organisational change is useful in informing the types of findings available from different strands of research on organisational change. The organisational change research literature (Weick & Quinn, 1999) has been described as a "sheer sprawl", because there is a large volume of literature which is often contradictory. Van de Ven and Poole's classification of research types helped me to impose order on the literature, devise methods to investigate change, and understand recommendations that can be made from particular research designs.

2.3 Situating 1: Professional context – computer usage by nurses

The culture of computer usage is varies markedly across different professions. For example, the diffusion of presentation software (e.g. Powerpoint), and learning management systems in higher education was rapid and near universal. Computer usage in schools has lagged behind this, as school teachers are often reluctant computer-users (Mumtaz, 2000). Rates of computer adoption also vary in different sectors and professions in the health sector (Greenhalgh, Robert, Bate, Macfarlane & Kyriakidou, 2005).

This section situates where nurses are positioned as adopters of IT in Australia. The main source of information was a series of papers which describe a questionnaire study administered by Robert Eley and colleagues. Eley's research was conducted on behalf of the Australian Nursing Federation and the Australian Government Department of Health and Ageing.

By the year 2005 computers were becoming increasingly commonly used within the nursing profession. This usage was mainly by registered nurses and to a lesser extent by enrolled nurses (Eley, Fallon, Soar, Buikstra & Hegney, 2006). The large-scale questionnaire survey of nurses in Australia. Eley, Fallon, Soar, Buikstra and Hegney (2009) found that lack of education, training and knowledge of computers were the most significant variables associated with a slow adoption in the profession. In fact, potential benefits of using information technology were not widely perceived by the nurses studied (Eley, Soar, Buikstra, Fallon & Hegney, 2009; Eley et al., 2006, 2009).

While these cross-sectional questionnaire surveys of the Australian nursing profession were large (n=4,300), the published papers do not show differences between nurses' computer use in hospitals, community nursing, and aged care settings. Thus their findings were of limited use for my study, as they did not differentiate between the different nursing sectors. Nevertheless the results are useful for situating the general culture-of-computing found in nursing.

These findings suggest that there may be substantial problems of confirmation bias among research participants (Nickerson, 1998) – that is answering questions based on the respondents' perception of the researchers' expectations. The answer to the

questionnaire item "the use of IT has made my job easier" (Eley et al., 2009) illustrates this. Of all respondents, 42.5% of nurses agreed with this statement, 11.9% were neutral, and the remaining 31.2% disagreed. However, the assistants in nursing, of whom only 20% used computers regularly at work tended to agree more strongly with the statement than the professional nurses. The workers who agreed that the computers are most useful were also those who according to their job role used them least. This possibly indicates that these respondents provided the answer that they thought was the most correct, or what the researcher wanted to receive, rather than an honest reflection of their opinion. While this could be because their limited use of computers is of very high utility, my field observations suggest that this is unlikely. This seems to be an example of confirmation bias (Nickerson, 1998). Confirmation bias in questionnaires can be reduced by utilising techniques such as the use of a 'lie scale' (checking the consistency of answers by having questions that are contradictory) as often used in personality testing (e.g. Thomas & Hersen, 2003, p. 136).

Another technique to improve rigour is the use of multiple questions (a psychometric scale – Nunnally & Bernstein, 1994)) centred around the same aspects of computer usage such that a statistically reliable scale is developed. A more rigorous large sample psychometric evaluation of nurse population's attitudes to computers seems not to exist. On a smaller scale Yu et al. (2009) showed that job role is a small but significant determinant of user perception of usefulness of software in their assessment of acceptance of electronic nursing documentation in RACHs.

The possibility of confirmation bias, confounds how much can be concluded di-

rectly about how useful nurses find computers in the workplace. Nonetheless, it does suggest that many nurses *want* to find computers useful in the workplace, even when opportunities to do so are limited. In other words, the response of the sample to this question suggests a culture where nurses generally want to be seen as cooperating with, and embracing new technology.

Yu et al. (2009), raised questions about the effects of the implementation of electronic nursing documentation into the organisation, and on the individuals within the organisation. For example, does the introduction of electronic nursing documentation lead to improved job satisfaction? Job satisfaction is an active area of research in nursing studies reviewed by Lu, While and Louise Barriball (2005). The question of job satisfaction's relationship to computer use in RACHs is raised here because RACHs are an environment where opportunities for career progression are limited (Lumby, 2001), where work is low status, poorly paid and physically demanding, leading to low staff morale and high staff turnover (Schwartz, 1974; Banaszak-Holl & Hines, 1996; Chou, Boldy & Lee, 2002; Ball, Weaver & Abbott, 2003). Managing staffing well is vital in RACHs because the floor nursing staff are a critical resource, without which normal business can not continue. This is true both from the standpoint of having the facilities' core business function fulfilled, as well as meeting the regulatory requirements. Fulfilling the latter requires adequate staff recruitment and retention to achieve legislated staffing levels.

It is clear from the literature that continuing education can have an effect on the job satisfaction of long term care nurses (e.g. Banaszak-Holl & Hines, 1996). However, it is

not clear that improving nurse's information technology capability through continuing education has the same kind of effect on job satisfaction as continuing education on care issues (Chou et al., 2002), although this may be changing as computer use has generally increased.

There is a substantial literature on IT education and competencies for nurses (Yang, Yu, Lin & Hsu, 2004; Garde, Harrison & Hovenga, 2005; McNeil et al., 2005; Smedley, 2005; Eley et al., 2006). Despite this, I have been unable to find evidence of a direct link between the implementation of nursing information systems and broad improvements in job satisfaction. However, if a nursing information system can improve efficiency, this could result in a reduction in the all too common job dissatisfaction in nursing (Ball et al., 2003). Given the discomfort and infrequent use of computers by nurses within the profession, making IT capability relate to job satisfaction seems challenging. Although maintaining staff morale and work quality is a serious management problem, care staff in RACHs often describe how rewarding they find their work on a personal level. This may be because IT skills are not directly related to the nurses' core duties of providing patient care – the main professional concern of nurses.

2.4 Situating 2: Organisational structure in health care, and aged care homes

Mintzberg's work on the varied organisational structures in different types of organisations (Mintzberg, 1996) suggested that health care organisations are a kind of profes-

sional bureaucracy. This is an organisational structure that relies on the standardisation of skills (e.g. nursing or medicine). However, the organisation's central activities are largely independent of the bureaucratic support structures that facilitate the organisation's function. However, healthcare organisations are more complex than this, and Mintzberg's earlier conception of organisational did not account for the diversity of stakeholders in healthcare organisations. Glouberman and Mintzberg's 2001 later discussion of the management of healthcare gives a more detailed, contextualised account of these organisations' structural features.

The core concepts used to create this framework for understanding the management of healthcare institutions are that of managing "up" or "down", and managing "'in"' or "'out"'. These spatial metaphors relate to two key factors underpinning healthcare organisations: cure and *care* of people, and *control* of resources. Glouberman and Minzberg's differentiate between cure and care in hospital settings as the difference between doctors, who provide active treatment of illness, and nurses who provide care for patients during their treatment, rehabilitation and maintenance. Specialists such as physiotherapists and psychologists are also included in the cure dimension. Doctors and allied health professionals are generally not employed by aged care providers, but as independent contractors, and are not directly managed by the aged care group. Nurses providing direct care to residents are directly employed and managed by the aged care group.

Managing "up" refers to managing into the environment dominated by external forces. In healthcare this particularly refers to the relationship between political and

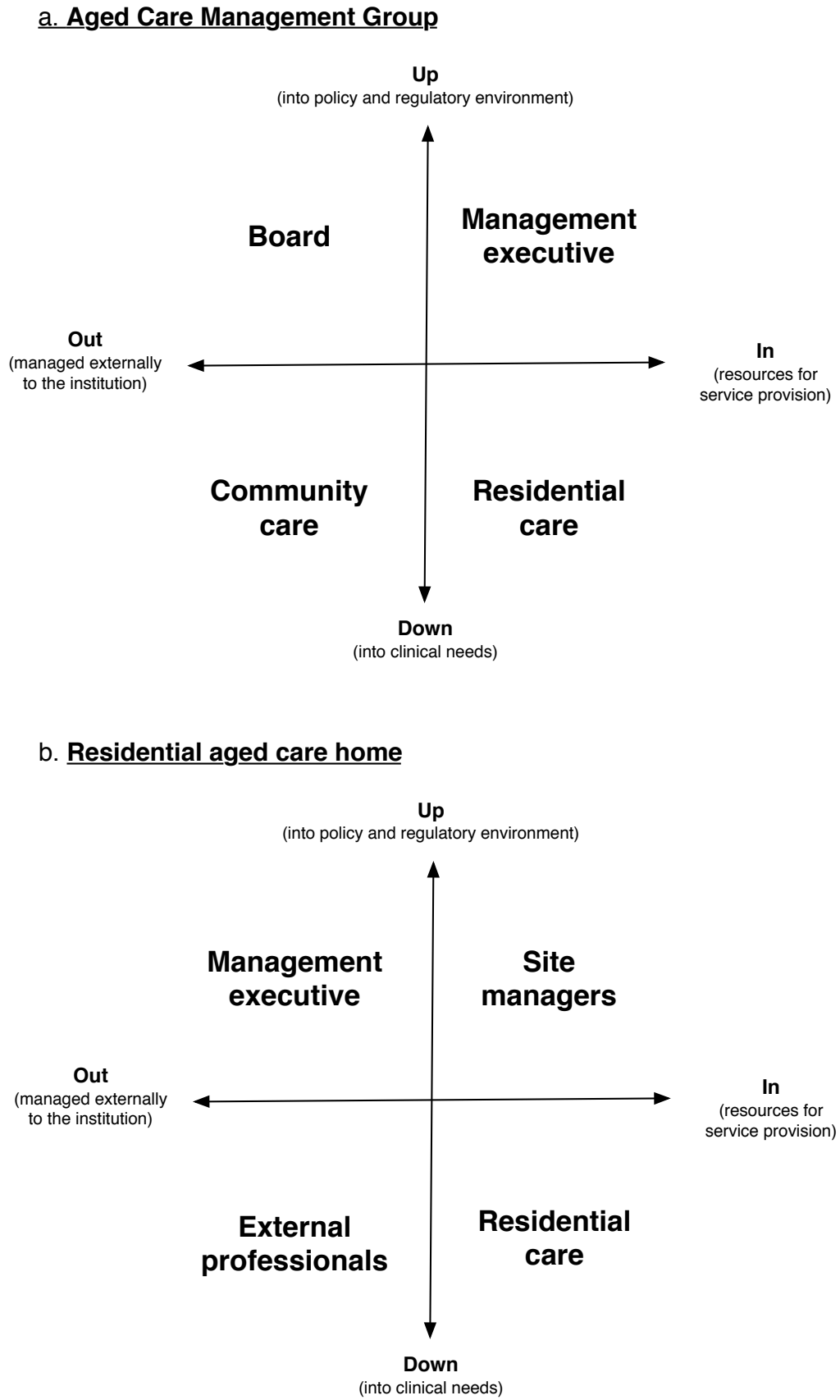

Figure 2.1: Schematic diagram of managerial relationships in aged care management groups, and residential aged care homes. Adapted from Glouberman and Mintzberg (2001)

regulatory environment that creates the which the organisation's structures and operational responsibilities. By contrast, managing "down" refers to discharging the operational responsibilities with appropriate resourcing and coordination of staff and materials in response to clinical need.

The managing "'in"' or "'out"' metaphor refers to who is accountable for work activities. Thus, at the macro-organisational level (i.e. whole management group), the board members manage "'out"', being answerable to external stakeholders (e.g. the community and other institutions referring to aged care services). Community need is also managed out into the community, by providing an interface for service provision outside the institution via general practice, hospitals or nursing clinics among other institutions. One of the goals of meeting community need is to keep people living at home, and thus outside the institution for as long as practical.

This management structure is characterised by the separation of administrative function from clinical function (such as supervising medications, supporting paramedical treatments and rehabilitation to improve activities of daily living), as well as the general caring function for residents to maintain their function. These are represented by the vertical arrows in fig. 2.1. This represents the separation between reporting to outside of the organisation, versus managing and reporting. In terms of understanding the organisational effects of the electronic health record, this framework for the divisions of function within the organisation can help the understanding of the the managerial purpose of the END, and how these impact on the workers within the organisation.

While most of my research is concerned with managing "in", the context requires consideration of managing "out" as well, as some staff, particularly the executive management group are primarily concerned with this aspect of the RACH operations.

This framework is incomplete because it disregards much of the multidisciplinary team approach that is prevalent in modern health care. However, it is a useful description of general organisational structures as the context of my work.

2.5 Grounding 1: Prior research on electronic nursing documentation

Nursing documentation is a major component of the clinical information stream across the health industry. It encompasses assessment, definition of patient problems, recording of nursing aims, planning of nursing tasks, execution of these tasks, and evaluation of care and care planning (Ammenwerth et al., 2001). reviewed 163 relevant publications from PubMed (NCBI, 2012), google scholar (Google Inc., 2012) and CINAHL (EBSCO Information Services, 2012) database searches on "electronic nursing documentation" and "computer-based nursing documentation" in order to better understand prior evaluation work in this field, and to identify prior management/organisational research.

2.5.1 Evaluation Studies

Table 2.1 shows that evaluation of electronic nursing documentation has been most commonly done using attitude surveys or by evaluation or analysis of work patterns/workflow. Applying Van de Ven and Poole's classification (Van de Ven & Poole, 2005, – see section 2.2.1), these are variance studies with the organisation considered as a fixed entity. Only one of the studies identified used mixed-methods – that is quantitative and qualitative analysis (Kossman & Scheidenhelm, 2008), and only one of these attitude survey studies was undertaken in the RACH setting (Yu, Hailey & Li, 2008).

Two of the four papers on RACH evaluation come from the research group that my study forms a part of (Yu, 2006; Yu et al., 2008). These papers show that good user acceptance of RACH electronic nursing documentation by staff, but do not investigate organisational issues in the context of system evaluation. One of the remaining two evaluation studies (Linder et al., 2006) is restricted in its scope, to the effect of electronic nursing documentation on compliance with advanced care directives. Advanced care directives are protocols for withholding of life-sustaining treatments when requested by the patient. This study examined electronic nursing documentation for a specific clinical use and could not be applied more widely.

The final identified paper on evaluation of RACH electronic nursing documentation (Staudinger, Staudinger, Them & Ostermann, 2007) had an organisational focus. It described the preliminary research on measurements for benchmarking the implementation of systems. The model it presented examined structural issues for technical

Evaluation Category	Count
Attitude Survey	8
Organisational	7
Work Pattern	6
Qualitative Clinical Inter-Professional Communication Documentation Quality Nursing home	4
Descriptive Study	3
Standardisation Software Design Behavioural Review Article Methodology	2
User Interface Technology Quasi-Experimental Qualitative Feasibility Randomised Experiment Education	1
Total categorisations	61

Table 2.1: Categorisation of evaluation studies from electronic nursing documentation literature search. Count cells are for each category, so for example, seven categories had only one paper in each category. Each paper can have more than one category, so the total is greater than 54

implementation and final evaluation of electronic nursing documentation and it paid relatively little attention to the people and organisational factors related to the end users of the system. Understanding the organisational impacts from the perspective of the end users is of vital importance in ensuring successful implementation and adaptation to change (Lorenzi & Riley, 2003). Due to this emphasis by Staudinger et al. on the beginning and end of the implementation, and relative neglect of the middle (shop floor) level where people and organisational factors become dominant in the change management process (Dawson, 2003), their publication was of limited relevance to my

research.

None of the other six evaluation studies, with organisational issues focus, are related to RACH settings. One PhD thesis evaluated the organisational effects of enhanced inter-professional communication in an adult intensive care unit (Collins, 2009). A neonatal intensive intensive care study (Rikli et al., 2009) investigated issues pertaining to the management of implementation of electronic nursing documentation investigated quality management using the clinical microsystems approach (Nelson, Batalden & Godfrey, 2007). Clinical microsystems focus on integrating new computer systems into existing workflows. Electronic nursing documentation has been particularly studied in intensive care because of the clinical intensity, high level nursing work, the medical technology usage and the importance of clinical documentation for patient management, especially in the event of litigation.

A further evaluation study of organisational issues reported acceptance of electronic nursing documentation in a rural hospital in the USA (Whittaker, Aufdenkamp & Tinley, 2009). In this case, the focus of the research was on barriers and facilitators to acceptance of electronic nursing documentation in the hospital setting. This reported specific behavioural issues as described by the Staggers and Parks Nurse-Computer Interaction Framework (Staggers & Parks, 1993). As with the clinical microsystems approach, this framework is implementation management oriented, is of limited relevance to my research.

The widely cited longitudinal evaluation of hospital-based electronic nursing documentation by Ammenwerth, Mansman et al. 2003a concentrates on nurses' acceptance

of workplace electronic systems. It notes the significant barriers to achieving the integration of electronic documentation with existing workflows. Factors associated with acceptance included the high staff turnover due reluctance of nurses to engage with IT systems associated with patient care because they lacked experience with computers at work. These results suggest that resistance can create a vicious circle. Lack of experience with computers in turn creates a lack of engagement which perpetuates the lack of hands-on experience. Ammenwerth, Mansman et.al suggest that once management have committed to implementing a new system, with appropriate training and frequent usage of the system, this barrier reduces.

Two of the remaining studies were in hospital settings. The first of these (Green & Thomas, 2008) examined quality improvement caused by the introduction of electronic records, in a specialist hospital clinic. Its specific focus was on physician's understanding of nursing documentation. The other hospital-based study (Moss, Berner & Savell, 2007) examined the organisational effects of novel electronic data collection protocols in intensive care. Another study (Robles, 2009) was a conceptual evaluation of the kinds of changes to work processes caused by the implementation of electronic documentation across an entire health board, and particularly highlighted the potential for Computerised Provider Entry Systems (CPOEs) to help nurses with reduced work complexity, and enhanced patient safety outcomes.

2.5.2 Organisational Studies

Including the nine studies already discussed, there were 28 results from the literature census that examined organisational issues surrounding electronic nursing documentation. These were categorised in the same way as the evaluation studies, and the categories are shown in table 2.2. It can be seen that evaluation studies (already covered) and inter-professional communication (two of which were jointly categorised as evaluation studies) are the two most common topics from this group of studies. Inter-professional communication (i.e. nurses' communication with other health professionals employed in the same organisation) is of limited relevance to the present study, so this will not be discussed further. Of particular interest to the present study is the literature on complexity, invisible work and diversity (discussed below).

There are two studies on documentation quality. The first (Stansfield, Yetman & Renwick, 2009) was part of the same research programme discussed at the end of the previous section (Robles, 2009). Stansfield's study aimed to examine the relationship between the implementation of electronic nursing documentation in hospital and patient outcomes. Broadly speaking their findings were that nurses using the system felt that there was potential for enhanced patient outcomes, but only with closer attention from software designers to workflow and user interface. The other study on documentation quality focused on quality management issues that could be addressed by the implementation of an electronic nursing documentation system in a hospital (Van der Mussele, De Sitter & Van Looy, 2006).

From early in my research, I identified the role of complexity of the relationship

between organisational change issues, and its role in the implementation of electronic nursing documentation (Diment, Yu & Garrety, 2011). My observation from an initial overview of the literature was that the vocabulary of complex adaptive systems was common within the literature (e.g. terms like emergence, interaction, wicked problems, and the highly interactive inter- and intra- organisational consequences of change). However, there have been few explicit attempts to link these concepts to implementation of IT in the health setting. Given this, and the relatively small amount of organisation focused investigations of electronic nursing documentation, it is unsurprising that only four publications on complexity were identified, including my publication.

A report on the response of nurses to the introduction of electronic documentation systems across the profession (Baker et al., 2007) uses the vocabulary of complexity (specifically 'emergent'). It lists a number of personal and organisational effects across the profession but without analysing the multilevel interactions inherent in a complex system. The remaining two publications on complexity on organisational issues within nursing informatics are PhD theses are discussed below.

Engesmo (Engesmo, 2008) studied the organisational changes affecting nurses following the introduction of electronic health records in Norwegian hospitals. My research has significant components in common with the present study, and based on Van de Ven and Poole's classification (Van de Ven & Poole, 2005) is a process/organisation as dynamic entity study. The primary sociological perspective used is symbolic interactionism (Manis & Meltzer, 1972). This sociological theory is commonly used in qualitative empirical work to investigate the interactive nature of social life, through

Category	Count
Evaluation Interprofessional communication	7
Complexity Clinical Work Pattern Qualitative	4
Invisible work	3
Technology Implementation Documentation Quality	2
Education Economic Descriptive Barriers	1

Table 2.2: Categorisation of electronic nursing documentation literature with an organisation studies focus. Count cells are for each category, so for example, nine categories had only one paper in each category

which social 'realities' are constructed. The symbolic interactionist perspective contains the important premise that the researchers themselves are the instrument used for conducting the research and collecting data. Engesmo also uses complexity theory in his research in order to account for the "patterns [which] emerge unpredictably from interaction embedded within a micro- and macro- level environment" (Engesmo, 2008, p. iii). Engesmo's study was participative action research. As a participant researcher had an influence on the implementation and management of the electronic documentation system.

There were two main empirical components of Engesmo's study: firstly the change of practice of nursing handover caused by the implementation of the electronic system, and secondly the impact on the organisation of introducing electronic nursing care

plans. The change in practice from exclusively verbal handover to "silent handover" comprised two-thirds of the allotted time when nurses just read patient notes, only with one-third verbal handover. The verbal time was generally for information not documented due to being "subjective or uncertain". The non-professional nurses were not required for parts of the verbal handover process, and so were available on the floor for longer. The consequence of the change in handover practice had resulted in reduced handover time, increased relevance, and better protection of confidential data. The successful implementation of this change in practice encouraged improved nursing documentation, and more efficient dissemination of workplace knowledge.

However, it is not clear that this silent handover practice would transfer well to the RACH environment, and other literature on silent handover does not support a dramatic improvement in information sharing at the change of shift (Dowding, 2001).

The second change in practice was the move to Electronic Nursing Care Plans (ENCP). This implementation was more problematic. With no guidance from the top of the organisation, and the implied desire for an immediate implementation of the ENCP, this resulted in substantial user resistance. Allowing the individual working unit managers to stage the implementation of ENCP ameliorated this problem somewhat, but did impair Engesmo's ability to draw conclusions about the change management issues surrounding ENCP in the time frame available for his research. However, this does suggest that major changes to work practices caused by the introduction of electronic documentation systems should be implemented with care and that assuming an introduction of an END will be unproblematic is unwarranted.

The final paper in the organisational and complexity category was Swinderman (Swinderman, 2005). Again focusing on nursing documentation in hospitals, Swinderman's thesis concerns the management issues pertaining to implementation of an electronic nursing documentation system from the perspective of the IT professionals. Swinderman as a nurse administrator was, as with Engesmo, engaged in participative research. In this case, Swinderman was a member of the implementation team straddling two worlds – as an informatician, and as a nurse professional. The focus of the research is thus situated in this frame: the needs of implementers for understanding nurses workflow and documentation requirements. Correct provision of these requirements should provide software that meets the clinical and administrative needs of nursing professionals in hospital. As with Engesmo (2008), Swinderman also makes an appeal to complexity theories, although with an emphasis on chaos theory (a branch of complexity) as a metaphor for understanding aspects of the implementing e-health systems. The use of complexity theories, with their emphasis on dynamic interactions within the organisation means that this research falls in Van de Ven and Poole's 2005 dynamic organisation/process research classification. However the combination of quantitative and qualitative data (mixed methods) used in Swinderman's thesis suggests that some components of this research was based on the variance/organisation as fixed entity approach.

2.5.3 Invisible Work and Diversity

The concept of invisible work is important in nursing. The idea of invisible work is that there is a separation of paid and therefore 'visible' work from the rest of everyday activity. This appears to have its origins in the development of industrial society (Daniels, 1987). Invisible work is especially important in nursing work, in part due to the mismatch between what is explicitly paid work, and work which is unacknowledged, or not explicitly funded, and therefore invisible. Such work includes soothing patients, providing emotional support, and especially dealing with relatives. Pilot data I collected during the early stages of my work indicated that the lack of acknowledgement of invisible work was perceived as a problem by some staff. This was especially for work with residents' family members and the kinds of tasks required to build a rapport with the residents themselves. This is time-consuming and important for the reputation of an institution, but seemingly inadequately recognised in in the Australian government funding system for aged care. The lack of acknowledgement of invisible work may have flow on effects of the ability of aged care nurses to do their jobs to their own satisfaction. Along with the change in work practices brought about by the introduction of the electronic nursing documentation system, recognition of invisible work needs to be a component of understanding organisational change.

As well as in feminist sociology (Daniels, 1987) there has been more specific interest in invisible work as part of nursing studies (see Rodney & Varcoe, 2001, for a review). Two studies of electronic nursing documentation have looked explicitly at invisible work issues (Burkhart & Androwich, 2009; Petrovskaya, McIntyre & McDonald, 2009).

These are both published in the journal Advances in Nursing Science, and both are concerned with the gathering the requirements for electronic nursing documentation systems. Petrovskaya et. al discuss the requirements for incorporating invisible work into electronic nursing documentation based on their clinical experience. Burkhart & Androwich propose a methodology to measure one aspect of invisible work (spiritual care) within nursing.

Simpson (2001) examined how information systems, which have been devised primarily for the use of medical professionals and hospital administrators meet nurses' professional needs and the need to include invisible work in electronic nursing documentation in order to satisfy requirements arising from the professional culture of nursing. While the article takes a whole-organisational view of nursing documentation, it is focused on the technical needs of clinical nurses, integrating standardised nursing vocabulary. This type of research on standardised vocabularies forms the largest type of research in electronic nursing documentation and is part of a large technical research programme to enable data mining of nursing notes. This study therefore focuses on aligning technical issues with organisational issues, rather than understanding the social consequences of the implementing a new system.

2.5.4 Computers and nursing in aged care

Yu et al. (2009) investigated the effects of the implementation of electronic nursing documentation of the organisation of aged care, as well as upon individuals within the organisation. For example, does the introduction of electronic nursing documentation

lead to improved job satisfaction? The general question of job satisfaction is an active area of research in nursing studies reviewed by Lu et al. (2005).

While maintaining good staff morale and work quality is a challenging management problem (see section 2.3), care staff in RACHs often describe how rewarding they find their work on a personal level, although often not at the institutional level. It's clear from the literature that continuing education can have an effect on the job satisfaction of long term care nurses (e.g. Banaszak-Holl & Hines, 1996). However, it is not clear that improving nurse's information technology capability alone through continuing education has the same kind of effect on job satisfaction as continuing education on care issues (Chou et al., 2002). This lack of clear relationship is because IT skills are not directly related to the nurses' core duties of providing patient care – the main professional concern of nurses. There is some suggestion that a nursing information system by improving the efficiency of documentation can reduce complaints of overall job dissatisfaction in nursing (Ball et al., 2003). Although there is a substantial literature on IT education and competencies for nurses (Yang et al., 2004; Garde et al., 2005; McNeil et al., 2005; Eley et al., 2006), I have been unable to find literature that shows a direct link between the implementation of electronic nursing information systems and improvements in job satisfaction.

2.6 Grounding 2: Organisational research in health informatics

Lorenzi and Rilley's book, (Lorenzi & Riley, 2002) *Managing Technological Change: Organizational Aspects of Health Informatics* is aimed at managers of health informatics systems. Two related papers (Lorenzi & Riley, 2003; Lorenzi & Riley, 2000) are aimed at researchers dealing with organisational issues in the field. The earlier paper in particular contains useful information on important theories in the mainstream literature related on organisational change. This covers the importance of effective change management in avoiding information system implementation failure. Despite a large number of studies in the mainstream organisational change literature, these authors show this has been relatively neglected. People and the organisational issues in health informatics "have not received their due" (Lorenzi & Riley, 2003).

Their explanation for this lack of attention include: apparent invisibility of organisational issues compared to tangible IT infrastructure; the difficulty of measuring unpredictable complex social situations; the difficulty of understanding technical and non-technical managerial responsibilities related to health informatics; the difficulties that technical staff can have in orienting themselves to 'soft science' issues; the tendency to want to sideline non-technical work for health IT implementations that physically manifest as technical projects.

Lorenzi and Rilley (Lorenzi & Riley, 2000) discuss some important theories of change management and organisational development, and the study of planned change.

In particular they point to Lewin's stage theory of change (Lewin, 1947; Lewin, 1958). This is compatible with process research if the assumption that the change process under study has a logical basis for "freeze, change, refreeze". Lewin's stage theory is an early example of participative or "action research" (McNiff & Whitehead, 2002) as a method for problem-solving in organisational change research (Kaplan, 1991). Because action research is a participative methodology, it is not a useful approach for my observation based research.

Bonnie Kaplan's 1991 conference paper on models of organisational change presents three research models for studying change. These are the Lewininan approach mentioned above, the *Research and Development/Diffusion* approach and the *Social Interaction* approach.

According Rogers seminal book *Diffusion of Innovations* (Rogers, 1995) diffusion of innovations, end users are divided into five categories: innovators, early adopters, early majority, late majority and laggards. While suited to both participative and observational research, the diffusion approach is concerned with the voluntary take up of innovations. The usage of the electronic health record in my research was compulsory, as it is in health service reform more generally. Therefore Rogers work does not apply to implementing the END. This process is active, not a passive diffusion process. It does not address the expected conflict within organisations when compulsory implementation does not explore and manage individuals' attitudinal variations. Compulsory implementations must be structured, apparently ignores personal choice and the social interactions of change.

My central research questions concern the END implementation process including effects that emerge over time. Thus a process based approach grounded in a contextualist research approach. (Pettigrew, 1985; Dawson, 2003; Pettigrew, 1990; Van de Ven, 2007) – a social interactionist approach – was chosen to answer my research questions. Professor Greenhalgh's work seems especially promising in this area. Her relevant research output is discussed in section 2.7.

2.7 Approaching diagnosis: Evaluation of interpretive research at different scales in health informatics

Greenhalgh et al. (2013) published an evaluation of the four national e-health initiatives implemented in the four British nations, England, Scotland, Northern Ireland and Wales. The evaluation is summative in that it is a re-analysis and reflection of a number of evaluation studies for cross-case comparison, which can be considered a processual analysis (Dawson, 1994; Pettigrew, 1997). This is because the key areas of interest to the researchers were the context in which the implementation occurred, and the processes during implementation to reach the outcomes. One particular concept of importance to my research is from Patrick Dawson's work on the conception of the need for change (Dawson, 2008). Dawson suggests that for change management to be successful there must be a strong belief in the necessity of the change, which he

terms the conception of the need for change (Dawson, 2003). That includes how much stakeholders see the need for change, as well as the importance of achieving it. Better understanding the conception of the need for change can help identify issues like the importance of resistance to change and the balance between the imposition and choice of change.

Lessons from the English and Scottish implementations, the two larger and most contrasting programmes in Greenhalgh et.al's report are particularly relevant to my research. The important distinguishing features between the different national approaches identified by them included stakeholder alignment, resistance and the implementation/adoption rate.

As part of the stakeholder alignment assessment, the "benefits of END were often seen as self-evident" (United Kingdom Government Department of Health, 2010). The authors termed management issues as "hard" and "soft". Hard considerations included project management, technical provision, management of patient consent and systems integration. The soft considerations identified were informing the public, engaging clinicians and managing stakeholder concerns.

The English implementation was the most expensive (a budget 400 times the Scottish implementation), and less successful. The methods used varied markedly The English approach was of much broader scope, and more ambitious than the Scottish approach. The intention of the English system was to integrate disparate health IT systems, in order to link general practitioner, hospital and outpatient clinic IT systems. It was lead by public servants and IT vendors. By contrast, the Scottish system

was driven by clinicians, and only concerned with the sharing of critical information between hospital and general practitioners.

The Scottish system placed less emphasis on system integration partly because of the limitations agreed for the Scottish implementation, and partly because there is only one electronic health record product used in Scotland.

In England by comparison, there were multiple computerised health record systems in use. Some of the suppliers were unwilling or unable to provide systems integration features for their software. This excluded some vendors from participating in the implementation. This lack of ability to engage with the new integrated system limited the country's implementation.

Because the Scottish system was clearly intended for clinical use only, there was little resistance to its adoption. The end users were primarily doctors working in primary care and some of their support staff. The information was accessible to them only and not to patients. On the other hand the English system was intended to be patient accessible.

Because of professional and public concern about patient confidentiality and privacy, patient accessibility created serious anxieties about civil liberties. High levels of resistance to the programme from the public, doctors and other health workers and the mitigated against the successful implementation of the system.

The ambitious scope of the English system which could not be fully realised, and the strong resistance to its adoption resulted in that implementing being regarded of questionable success at best. The simpler Scottish system with a more restricted

user base and vastly simpler system integration problems, met with a low resistance rate. This lead to rapid adoption by all end-users. These results caution against bureaucracy/vendor implementation rather than clinician lead which was able to resolve concerns about confidentiality and security of the record.

This outcome of these evaluations were reached through what Weick (1990) and Orlikowski and Gash (1994) referred to as 'naming and framing'. That is, the research presented by Greenhalgh et.al explored the institutional, interpersonal, psychological, and organisational factors that create the research situation, and the findings that emerged from it. Weick's abstract describes this approach to research succinctly:

> [["Naming and framing provides] conceptual shifts that help us understand the organisational implications of [the proprieties of new technologies –] definitions of technology stochastic events / continuous events / abstract events from structure to structuration / from analysis to affect / from static to dynamic interactive complexity [and] from behaviour and output control to premise control."

Prosaically , 'premise control' refers to the way that people think about their situation. This is particularly important in reference to the logical understanding actors have about the implementation process. For example, there can be fixed views (e.g. this is an exclusively technological problem) versus flexible views (e.g. the technology exists to assist solving a problem made up from of social, occupational and/or organisational issues). Lorenzi and Riley (2003) allude to this when they cite Watzlawick, Weakland and Fisch (1974), although this is not examined in detail in their paper. Watzlawick

and Fitch's work is particularly interesting with respect to the idea of understanding problems and seeking solutions by reframing the way that things are understood.

2.7.1 Small scale interpretive case study research. Theoretical lessons from an evaluation of the British e-health reforms

"Why National eHealth Programs Need Dead Philosophers: Witgensteinian Reflections on Policymakers' Reluctance to Learn From History" (Greenhalgh et al., 2011) is a much more theoretical paper. It is a reflective analysis of a single case study. The case study itself is about a London-based diabetes specialist who was an early adopter of eHealth technology. This doctor had driven a successful, locality and speciality based , small scale eHealth implementation of an integrated health record. The software enabled data sharing for diabetes patients attending the hospital trust or associated primary care and community care facilities. Thus usage radiated outwards from the diabetes clinic and the integrated record covered a population of "several thousand" individuals.

Neither the Scottish e-health programme nor my study has published a case study of patient involvement. However the anticipated national English system was intended to be patient accessible, based on a formal, more technocratic development process that did not heed case study examples. As a result this technical system was beset by errors during development – perhaps because they did not appropriately court the

cooperation of the system's users. These errors included system slowdowns, and login failures which the vendors seemed to be unable to remediate. Blame-shifting between vendors and end users did not help.

The theoretical part of Greenhalgh et.al 2011 demonstrates how to draw conclusions from case studies like these, as they are do not follow the experimental (hypothetico-deductive) model. The authors identified the following as important factors in the course and outcome of the two implementations, and identified the following features of success:

- a locally driven, 'ad hoc' system versus a nationally imposed system;
- clinician rather than technocratic leadership process;
- allowing for non-clinical stakeholders requirements and values
- explaining the benefits of the system and engaging the support of clinicians and patients

This type of research cannot be described as experimental. Despite the popularity of a clinical-trial model for evaluating ehealth systems (Liu & Wyatt, 2011), identifying dependent variables and independent variables, let alone performing systematic manipulation is not possible because the process of implementation is dynamic and frequently changing required. Thus much of the Liu and Watts paper discusses the difficulties of the experimental approach to research compared to a richer, more explanatory interpretivist approach, inspired by the philosophical movement of which

Wittgenstein was an exemplar. Greenhalgh et al. (2011) presents the dynamic variables (e.g. stakeholders, contexts and events), how these contributed to the research situation, and developed an understanding how process and outcomes arise as a result.

2.7.1.1 Experimental model versus "heuristic generalisation"

The experimental model, otherwise termed the hypothetico-deductive model is the scientific approach to understanding. At it's core a scientifically framed question will have an alternative hypothesis and a null hypothesis. The null is necessarily the logical negation of the alternative hypothesis. Thus a scientific question is formed via the logical premise: $P \neq !P$ where P is either true or it is not true. It is required that P is precisely defined.

The hypothetico-deductive model can only generate knowledge in small steps, in a restricted problem space, and is only tractable to simple causal mechanisms. Generalisation is made by induction. That is: if P is true then phenomena closely related to P are also assumed to be true until evidence is supplied otherwise. The hypothetico-deductive model requires a strong relationship between experimental models and observed associations reflecting the phenomenon under study. Therefore the hypothetico-deductive model can not be used where hypotheses can not be precisely defined. (Greenhalgh et al., 2011) dismiss this model with three questions:

- "If we reject experimental and quasi-experimental studies on the grounds that they lack predictive power, how can we defend the case study against the counter charge of lack of generalisability (and the logical extension of this charge, that

the richer a case study becomes, the less generalisable it will be)?"

- "How (if at all) can any level of prediction be achieved when the data set comprises a handful of descriptive studies, each of which is unique and unreplicable?"

- "To what extent (if at all) can the findings from such studies be used to inform program planning in another context or setting? How many cases are sufficient for a small-n sample? What is the significance (if any) of the sample of just one study?"

To overcome these problems, the authors define the term "heuristic generalisation" as a counterpoint to the inductive generalisation used by the hypothetico-deductive model. The Oxford Dictionary of Psychology (Colman, 2008) defines a heuristic as a procedure "for making a decision, forming a judgement, or solving a problem without the application of an algorithm or an exhaustive comparison of all available options, and hence without any guarantee of obtaining a correct or optimal result." Where a problem space is not sufficiently well defined so that meaningful experimental questions can be asked, a heuristic based approach seems the only option. An emphasis on understanding many different points of view – as broad a range of stakeholders as practical enables the researcher to explore the varied personal and organisational contexts that new technologies are encountered in. In the absence of other sociological or organisational definitions, this explains Greenhalgh et. al's approach.

2.8 Conclusion

2.8.1 Relevance to research questions

Having explored an approach to diagnostics, I return to the research questions in order to justify the relationship between the components of Engaged Research above, and how these relate to the research questions presented in chapter 1.

Understanding the contextual features of the END introduction is largely concerned with situating and grounding the research and includes three broad-based factors. These are:

- Understanding what people do at work in terms of day to day activities.
- Understanding how they feel about various aspects of their work from a behavioural and emotional level.
- Understanding how work is regulated and organised, both formally and informally.

Research question one – what defines a successful outcome? This requires an understanding of the differences between the study sites with an emphasis on how the END helped to meet organisational and individual goals. The grounding of this question relates to the conception of the need for change (Dawson, 2003).

Research question two – Does the context create a sensitivity to initial condition causing a difference between sites? and research question three – how do staff at different levels of the organisation perceive the outcome? are two separate approaches

to the reactions to change. Variation between individuals is also important. Diagnosis requires close attention to the research data collected. Sensitisation to key concepts, systematic data collection and analysis, and understanding of the structure of the organisation provide the evidence basis for my study. Understanding organisational change after introduction of a END relies on what emerges from the data and heuristic reasoning provides my findings and recommendations.

Chapter 3

Methodology & Method

3.1 Review of methodology

A sociological view of implementation of technology in health information technology (IT) research should account for the importance of experience and the intersubjective nature of social life. Intersubjectivity refers to "the common sense shared meanings constructed by people and their interactions with each other and used as an everyday resource to interpret the meaning of elements of social and cultural life" (Seale, 2004, p. 508). The majority of health informatics evaluations do not take this approach. Instead, they are dominated by quantitative work, with 80% of evaluations surveyed in a systematic literature review of publications from 1982 to 2002 being primarily quantitative studies (Ammenwerth & de Keizer, 2005). Only five percent of studies exclusively used qualitative in focus, while the remaining studies examined either used mixed methodology or did not specify their methods. Since Ammenwerth & de Keizer

published their inventory, their research group has continued to add articles to the database (available at http://evaldb.umit.at). From 2003 to 2009, of the 347 additional papers in the database, 53% were quantitative, 29% used mixed method approaches, and 18% were qualitative, indicating that during this time, qualitative approaches to health informatics evaluations have become much more widely used. However, selecting appropriate methodology with which to perform qualitative research in health informatics is still a challenge and requires careful consideration.

It is my purpose to enter into the conflict between quantitative and qualitative methods in health informatics (strictly this would be described as between positivist and interpretivist methods), and in organisation research more generally. However, it is worth noting that two papers published about health informatics evaluation provide radically different views about methodology, which illustrate this conflict well. Urquhart and Currell (2005) examined the current state of evaluations in medical informatics and strongly recommend the greater use of randomised controlled experimental studies in order to facilitate the production of a Cochrane review in the field. However, Currie (2005) argued that such methodology is not appropriate in many evaluation situations, a position supported by Kaplan and Shaw (2004). While experimental studies are suitable for simple interventions with restricted scope in time and space, they are unable to capture the rich complex processes inherent in the more typical incremental implementations, likely to have a longer implementation time, and more widely distributed within or between organisations. Van de Ven and Poole (2005) (see chapter 2), argued that time must be viewed in different ways depending on which

methodological perspective is used. Given the focus of my research on change management issues, the associated complexity and dynamic response over time, and the impossibility of running proper experimental controls, pragmatic qualitative methods are clearly a strong and valid approach (Kaplan, 2001; Dawson, 2003).

The most popular methodology for qualitative research in organisation studies (of which organisational issues health informatics can be viewed as a sub field) is Grounded Theory (Glaser & Strauss, 1967). This is a systematic data-driven methodology, which in a sense represents a reversal of the usual hypothetico-deductive method. Instead of generating hypotheses at the beginning of the research process, transcript data is coded to identify emergent themes, and then the themes are used to refine and test the generated hypothesis (*ibid*). In this way, grounded theory is an iterative process of continuous comparison, which has been popular in research on organisations (Martin & Turner, 1986). However, examining the use of grounded theory in health informatics research suggests that while it is suited to micro-sociological situations with a limited range of actors in similar social situations (Irurita, 1996; Akbar, 2002; Embi et al., 2004; Hendy, Fulop, Reeves, Hutchings & Collin, 2007), the risk of information overload is high (Miles, 1979). This limited scope of suitability of grounded theory makes the kind of rich macro-sociological comparisons across individuals and groups in different social situations – as aimed for in my research – difficult.

The dominance of the grounded theory approach to qualitative research, along with the dominance of a statistical approach to data analysis in many areas of business focused social science research, has resulted in a range of methodological problems. In

the organisation studies literature in general there is a strong tendency for qualitative methods to be insufficiently detailed to allow a paper's readership to understand the procedures used to analyse a qualitative data set. This is a problem that has become more widespread in recent years, in part due to the way that much qualitative data analysis software encourages a checklist-type approach to analysis (Jones & Diment, 2010). Cautions about a purely procedural checklist approach based on the epistemology of quantitative research are a recurring theme in the literature (Barbour, 2001, 2003; Stige, Malterud & Midtgarden, 2009).

The research questions pertaining to the present study encompass a wide range of themes. As well as the clinical and administrative effects of the documentation system, we need to know how management effect its implementation of the system, how their view of the role and capability of the documentation system affect the implementation. This in turn affects the non-managerial staff's ability and willingness to use the documentation system. This multi-layered situation requires a view of organisational complexity and the hierarchical nature of the situation becomes important (Gemmill & Smith, 1985; Anderson, 1999; Anderson, Issel & McDaniel, 2003; Begun, Zimmerman & Dooley, 2003; Maguire, McKelvey, Mirabeau & Oztas, 2006). The remainder of this section discusses a data analysis technique based on the sociological technique of Institutional Ethnography (IE) which can account for this embedded complexity while guarding against the risk of information overload.

Institutional Ethnography (Campbell, 1998, 2001, 2004; Smith, 2001; Smith, 2005) is a sociological technique which attempts to account for the social organisation of

knowledge using a materialist empirical approach (Rankin, 2008, p. 4). In this context materialism refers to a close linking of mental life with its physical manifestation in behaviours and activities. Its core ontological position is that social life can be seen as organised by "ruling relations" organised through texts or text-mediated processes (DeVault & McCoy, 2006). Ruling relations refers to the embeddedness of individuals within a social hierarchy, which mediates their relationships to social life. IE as been used widely in research in the sociology of nursing (Campbell & Jackson, 1992; Campbell, 2001; Mykhalovskiy, 2001; Rankin, 2001; Rankin, 2003, 2008; Kirkham & Anderson, 2002; Vukic & Keddy, 2002; Paterson, Osborne & Gregory, 2003; McKenzie, 2006). There are also a small number of studies which use the approach in health informatics research (Moehr, Berenji, Green & Kagolovsky, 2001; Poland, Lehoux, Holmes & Andrews, 2005). Because IE emphasises the fact that research participants are embedded in a broader highly interactive social hierarchy, it fits well with the Engaged Research approach discussed (see section 2.2), due to the mutual importance of situating and contextualising the research. It provides a framework in which to understand the organisational change processes as having simultaneously bottom-up and top-down features as per the systems view of change management (Cao, Clarke & Lehaney, 2004). It is therefore a good candidate methodology for the present study, especially with respect to the research questions and accounting for the research participant's place within the organisational hierarchy.

Strategies for data analysis for IE research tend to be more flexible than other approaches to qualitative data analysis. Rather than the grounded theory, or Situa-

tional Analysis (Clarke, 2005) approach of coding data into emergent themes and using this to generate hypotheses and relationships, IE takes a simpler, non-prescriptive approach to coding, which tends to avoid this formal analytic strategy, preferring to simply group parts of interview transcripts into an index of related items (DeVault & McCoy, 2006, pp. 769-771). As a result, the substantial risks of information overload that are inherent in more immersive coding procedures are much reduced. This index-based approach to coding results from the materialist origins of IE, and has guided my approach to analysis of the interview transcripts.

I used an materialist approach to coding my data in the sense that my top level categories of interviews were closely related to the interview topic as per the top level headings in section 3.2.3.1. Where the conversation strayed to different topics the coding reflected this. IE itself is centred on the intuitions of paid and unpaid work, and IE interviews are centred on understanding the social nature of work (DeVault & McCoy, 2006, p. 759). In the context of my research this means that I did not analyse the interviews by reading transcripts and using an open-ended iterative coding approach. Instead the initial codes were closely linked to the themes inquired about during the interviews. Thus the analysis was closely linked to the material content of the interviews. As such while the analysis approach described in section 3.3.1 is inspired by techniques used by institutional ethnographers, my research is not a piece of IE itself.

3.2 Methods

According to Ammenwerth et.al. 2003, qualitative research into organisational issues arising from health information systems research is more suitable than quantitative work where contextual issues are important. Context is important when understanding the convergent and divergent views of different stakeholders is required to explain observations. I used this approach in my study, which is an exploratory investigation of organisational issues, and user perceptions of the implementation of a new electronic record system. I conducted a comparative, longitudinal study of two Residential Aged Care Homes (RACHs) by interviewing managers and care staff on three occasions: before implementation, six and 12 months post implementation.

In addition to being guided by the engaged research approach, data collection and analysis was also influenced by the processual approach to understanding organisational change (Dawson, 1994; Pettigrew, 1997; Buchanan & Dawson, 2007). Processual models of change differ from stage models (e.g. Lewin's freeze/change/refreeze model (Lewin, 1951), by emphasising the dynamic nature of change. It accommodates multiple, and sometimes competing viewpoints. This attempt to accommodate multiple viewpoints is particularly useful for our study because it emphasises contextual issues. This can help the researchers to generate a holistic narrative account of the perceived benefits and other consequences associated with the change in record system.

3.2.1 Study Sites

This project was conducted in three RACHs belonging to the same management group. There were two main study sites, and a supplementary site.

The first facility, which I have called the "regional site", is in a suburb approximately 20 kilometres from the nearest city centre. The corporate office of the management group was located on the same site as the RACH. The city's population is approximately 400,000, with a large proportion being located within a short distance of the home. The regional RACH has 140 beds, with 60 beds in low care, 69 in high care and 11 in the secure dementia unit.

The second RACH, called the "rural site", is located approximately 120 kilometres from the corporate office of the management group on the edge of a central town. The population of the region is approximately 40,000. The RACH itself was of the same modern spacious design as the regional site. The rural home had a total of 120 beds, with 80 beds in high care, 24 beds in low care, and 16 beds in the secure unit. Both RACHs had the similar staff ratios.

The third, "rural supplementary site" is located equidistant from the regional site, in a relatively isolated location. This was a newly built home of similar size to the other sites, but running at reduced occupancy at twelve moths post-implementation with correspondingly fewer staff. This site was included as a green field site in order compare a home where there had never been a paper-based documentation, versus to the two homes transitioning from paper to electronic systems.

At all sites, all residents were housed in single-bed rooms. In Australia, high care

residents are those identified by government assessors as needing comprehensive assistance with most daily living activities; low care residents are those in need of services including meals, laundry and cleaning, and some additional help with personal care (Productivity Commission, 2011). The secure unit houses mobile, low care residents with severe behavioural problems such as dementia. If these residents' condition deteriorates so that they are no longer mobile, they will be moved to high care.

In high care, Personal Care Worker (PCW) looks after seven residents. In the secure unit, the ratio is one PCW per 10 residents; in low care it is one PCW to 25 residents. Low care is overseen by the Low Care Team Leader (LCTL), while in high care there are two or three Registered Nurses (RNs), or one Enrolled Nurse (EN) and two RNs in a morning shift. As both main study sites are of roughly the same size and occupancy, the absolute numbers of staff during each shift, described below were approximately equal.

There was one RN or one EN in the afternoon shift. At night, one RN supervised the whole site. The Residential Services Manager (RSM) and their Deputy Residential Services Manager (DRSM) oversaw the operation of the whole home. The RNs report directly to the RSM and DRSM, the ENs to the RNs. Fewer people used the system at the rural supplementary site, both due to low occupancy and the way the introduction was managed (see section 5.3.3). Therefore, proportionately fewer PCW were interviewed here.

3.2.2 System implementation

The provision of hardware and network infrastructure, and the deployment of the software, was almost identical at both main study sites. The electronic system, an off-the-shelf web-application running on thin client workstations, was introduced to staff at around the same time. A train-the-trainer training model was used for introducing the system to the workforce, followed by a staged implementation, with new features being introduced to end-users over a six to nine month period.

Training of floor staff began with instructions on how to use progress notes which are daily exception reports on individual residents. This was followed by the introduction of incident/accident reports, clinical forms and charts (e.g. blood sugar measurements), and finally electronic care planning, and resident reviews.

3.2.3 The development of semi-structured interview questions

The interview questions were constructed based on the reformulated DeLone and McLean's information systems success model (DeLone & McLean, 2003). This states that there are six variables that directly determine Information Systems (IS) success: system quality, information quality, service quality, use, user satisfaction and net benefits. The interview questions were drafted to elicit care staff's perceptions of the performance of each of the above six variables as well as demographics, computer skills, work practices, the implementation processes, documentation practice, training, support and system maintenance.

The face validity of the interview guide was established by a group discussion with

a panel of seven key informants, including five experienced nursing managers and two information system managers in an aged care organisation. The guide was then piloted by using it to interview two care staff members at each level of an RACH. The interview guide was refined through the pilot. At all stages of the research participants were solicited in the workplace, and gave explicit written consent as required by the University of Wollongong human research ethics committee.

3.2.3.1 Interview Questions

The list of all questions in the interview proforma are given below. As the interviews were relatively informal in nature, with the aim for the tone to be conversational rather than inquisitorial, not all questions were asked to all participants. Nonetheless, most of the below questions (including all questions pertaining to collecting demographic data, benefits and problems with the software) were asked of most participants.

- Demographic information
  - What is your role in the facility?
  - How long have you worked in the facility?
  - Which shift do you normally work?
  - Could you please describe a typical day of your work?
  - What do you think about the software?
  - What are its strengths and weakness?

  - Are there opportunities and threats brought by the introduction of the software?

- System usage, training, support and self-efficacy
  - When did you start to use the software?
  - Can you describe your experience with the software?
  - From your experience, is the software used well?
  - How would you say your computer skills when you started to use the software?
  - How long did it take you to get to your current level of usage?
  - How is training and support for staff organised?
  - Does the training meet your needs?
  - If not, what can be improved?

- The quality of the software
  - Which aspects of the software, if any, are you most happy with and why?
  - Which aspects of the software, if any, are you most frustrated with?
  - Do you have any concerns with the software? What are they?

- Information
  - What information do you enter into computer?
  - What do you write on paper, if anything?

  - Where do you enter data?
  - When do you enter data?
  - How do you you find information about specific residents when you need it?

- Time frame
  - When do you think the implementation will be stable in the home with everyone comfortable with the system, and introduction complete?
  - How long did/will it take you to be completely comfortable with the software?
  - How long did/will it take other staff to be completely comfortable with the software?

- Impact of the system
  - Is there any improvement in residential care caused by using the software?
  - Are there any changes in work practices that are brought about by using the software compared with the paper-based documentation?

- Questions for RNs
  - What are the biggest challenges you face in delivering quality care to residents?
  - Does the software help with providing quality care?

  - Does the software facilitate communication with outside health providers, such as visiting doctors?
  - How might the software impact nursing judgement?
  - In which ways does the software help to improve clinical judgement?

- Questions for RSM, DRSM and LCTL
  - When did you start and finish the implementation of the software?
  - What are the implementation strategies you used?
  - What were the challenges you encountered in implementing the software?
  - What are the challenges now?
  - What are the risks using the software?
  - What benefits have been realised to date?
  - What are the risks of electronic documentation?
  - What are your concerns in going down this track?
  - What are you planning to do with the software?
  - What lessons can be learned from implementing the software in your home?
  - If you were to do it again, what would you do differently?

3.3 Data collection

Interviews commenced in 2009 just after floor-staff training on the new system had been completed but before the system had been fully deployed at the regional and

rural sites. The system had already been in place at the rural supplementary site for around eighteen months. Follow-up interviews were conducted six and 12 months after the initial visit.

I conducted interviews over two days at each site visit. All available managers were interviewed at every visit. The other staff were selected by convenience sampling based on the availability of the staff members and their willingness to participate in the study.

Interviews lasted between 10 and 40 minutes, and were conducted during the morning and afternoon shifts at each site, beginning with either the RSM or DRSM. The longer interviews tended to be with managers, or with carers who were trainers for the Electronic Nursing Documentation (END). Five out of the ten trainers were interviewed at the regional site, and four out of ten at the rural site.

Initially I attempted to sample each type of staff working on the floor (i.e. RNs, ENs and PCWs). As the visits progressed it became apparent that while this was a good strategy for finding RNs and ENs, some PCWs, particularly those in high care, made very little use of the record system in their work. These staff had very little to say about the END. Therefore in the latter rounds of interviews we performed more targeted sampling by mainly interviewing RNs and ENs in high care and PCWs in the low care units.

3.3.1 Analysis of Data

Interview recordings, approximately 22 hours in total, were transcribed and processed using a three stage coding procedure. Sections of each transcript were initially marked up by theme, for example, benefits, problems and care issues. Salient points were then summarised as memos. In the third stage, memos were aggregated into summaries that captured the views and comments of staff at different positions of the organisational hierarchy and stage of the implementation. This tag/retrieve/annotate coding was performed with standard Unix text processing tools detailed elsewhere (Diment, 2010). The use of this software ensured that these memos were closely linked to the original unprocessed transcripts and audio files, so while the data were quite heavily processed, they remained closely connected to their original raw forms. Retaining information within content-based topics, what Institutional Ethnographers call a materialist approach (DeVault & McCoy, 2006) rather than an open coding process, kept my research focused on the different processes that occurred during the longitudinal study. It allows for a description of change over time and enables highlighting the similarities and differences between the sites.

Chapter 4

Demographic Characteristics

This chapter initially describes the demographics of the interview participants across the study sites. In particular, the number of staff interviewed in each position; the length of time with the employer, and in the case of Personal Care Workers (PCWs) whether they work in high care, low care/dementia care, or a mixture. Following this description of qualitative demographics, the general information about staffs' prior career experiences before working with their current employer will be discussed. Related to this is a description of the information provided about self-perceived computer skills and experience both at work and elsewhere. Finally information about the staff members' expectations about how long they would take to be competent with the Electronic Nursing Documentation (END), and how long the operation of the END would take to be stable at the site are discussed. The chapter concludes by relating these demographic and skills related data to a broader context of increasing computer usage in the workplace and in society as a whole.

4.1 Description of interview participants

Overall, staff were overwhelmingly female. This was reflected by the interview sample: two males care staff were interviewed in the entire project, a Registered Nurse (RN) and a night shift PCW both at the rural site. Due to the sensitivity of the question, data on age was not systematically collected as part of the interview process. However some discussion of the observed age structure of the Residential Aged Care Home (RACH) staffing is given in section 5.1.3.

Figures 4.1 to 4.3 show a graphical visualisation of the counts of the different types of staff at each stage of field data collection. Total numbers of interviewees were similar at the regional and rural site at each stage, with 38 total interviews at each sites. There were only 19 interviews at the rural supplementary site, due in part to the lower occupancy levels than at the other two sites, and in part due to the different implementation strategy used (described in section 3.2.2). The graphical presentation in the figures serves as an alternative to a complex table, and enables easy visualisation of the differences in job role among interviews, and comparison among the sites.

For example the figures show that across all sites and data collection stages, a maximum of one enrolled nurse was interviewed at each visit. On three occasions (two at the rural supplementary site, and once at the regional site) there were no enrolled nurses available for interview. Similarly, the Residential Services Manager (RSM) was only available throughout the interviews at the regional site, otherwise only on one occasion at the rural supplementary site. This may indicate that the leadership of the implementation of the END was more commonly seen as a job for the Deputy

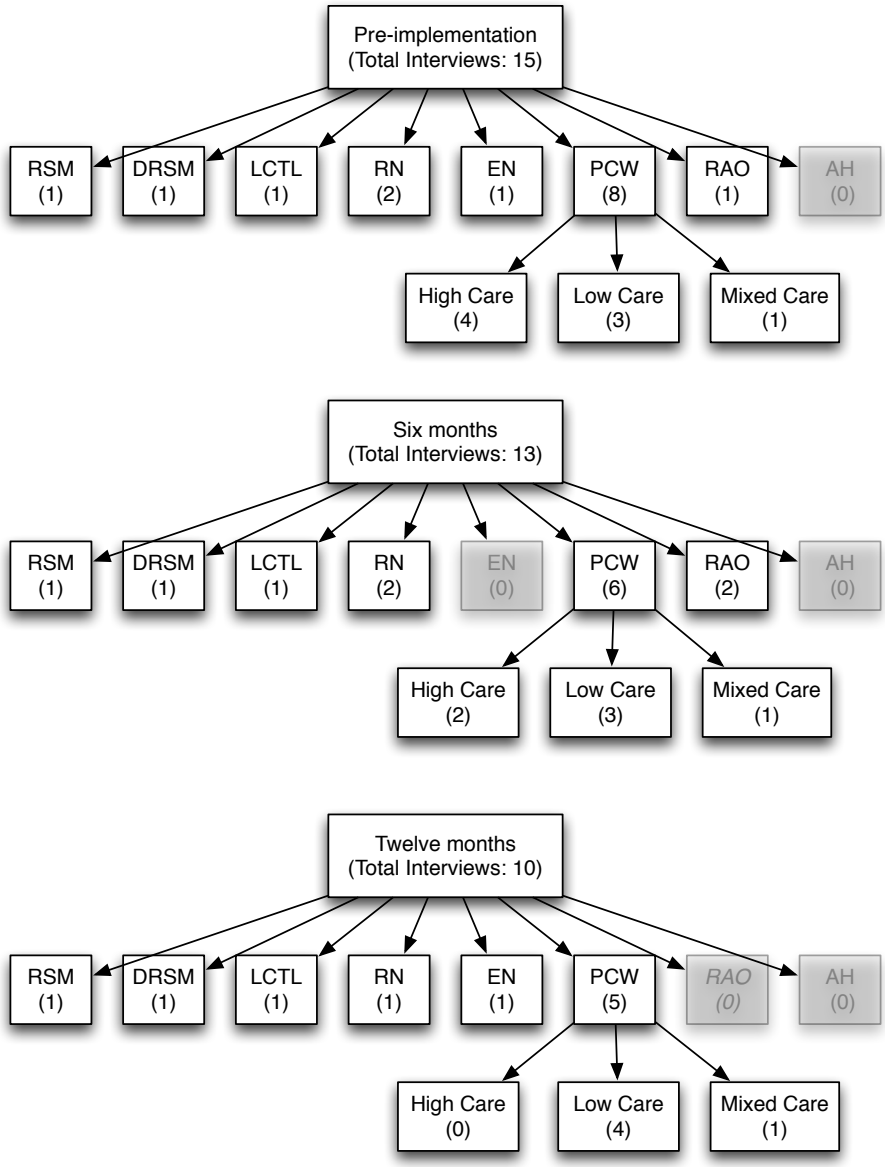

Figure 4.1: Number of interviewees by job role at regional site for each data collection stage.

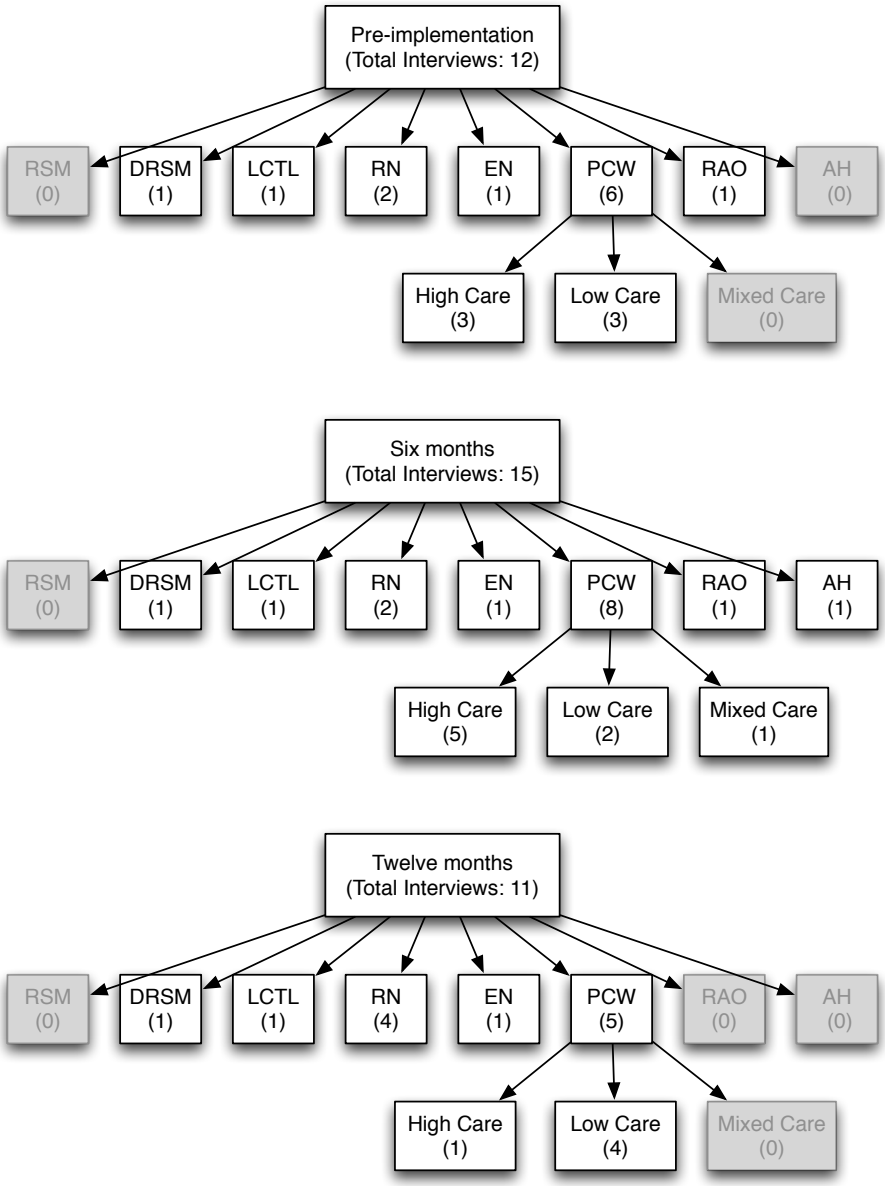

Figure 4.2: Number of interviewees by job role at rural site at each data collection stage.

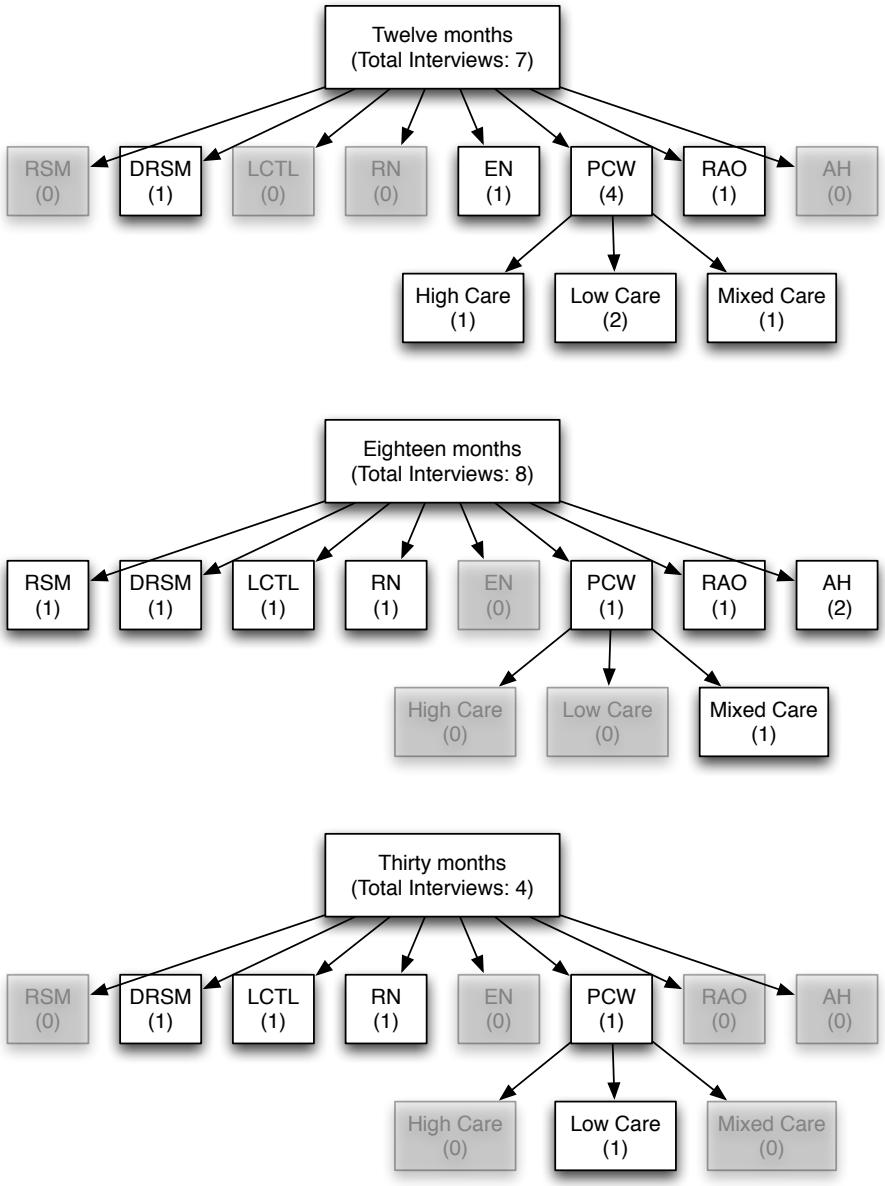

Figure 4.3: Number of interviewees by job role at rural supplementary site for each data collection stage.

Residential Services Manager (DRSM) at the study sites, although this observation was not confirmed at interview.

In general the DRSM is closer to the day-to-day clinical work than the RSM. Additionally of note in the three figures is the decline in the sampling of high care PCWs and Recreational Activities Officers (RAOs) over time. This was due to their lack of use of the system, although the reasons for this lack of use are interesting and will be discussed throughout the remaining chapters.

While the figures are useful for providing an overview of the sampling strategy, they do not make comparison of proportions easy. Due to the relatively low numbers of interviewees in each category (ranging between 0 and 5) and the hierarchical features of the data (i.e. PCWs being divided into high, low and mixed care), it is not appropriate to perform statistical tests (e.g.χ^2) to determine the similarity or differences among interviewees in different categories. Table 4.1 presents the proportion of staff of each type at each data collection point from which it can be seen that to a reasonable approximation (and excepting the diminishing sampling of low care PCWs at the later data connection points) that proportionate coverage was achieved as part of data collection.

4.2 Staff employment duration at each site

Table 4.2 shows the employment duration of the staff members at each site as both percentage of staff and as total counts by employment category. Important features by

Table 4.1: Percentage of each type of staff at each field visit (rows sum to 100%). Total percentages at each site are relative to the whole sample. At the rural supplementary site, interviews started at 12 months post-implementation

12 mo.						**HC**	**LC**	**MC**		
Regional										
Pre	6.7	6.7	6.7	13.3	6.7	26.7	20	6.7	6.7	
6 mo.	7.7	7.7	7.7	15.4		15.4	23.1	7.7	15.4	
12 mo.	10	10	10	10	10		40	10		
Rural										
Pre		8.3	8.3	16.7	8.3	25	25		8.3	
6 mo.		6.7	6.7	13.3	6.7	33.3	13.3	6.7	6.7	6.7
12 mo.		8.3	8.3	33.3	8.3	8.3	33.3			
Rural Supplementary										
12 mo.		14.3			14.3	14.3	28.6	14.3	14.3	
17 mo.	12.5	12.5	12.5	12.5				12.5	12.5	25
30 mo.		25	25	25			25			

Total percentages: Regional: 39.6%; Rural: 40.6%; Rural Supplementary: 19.8%

site are that it appears that staff interviewed at the regional site were on average newer than staff at the rural and rural supplementary site. For example, around 24% of staff interviewed at the regional site had worked for their current employer (i.e. could have worked in more than a single RACH during this time) for two years or less, compared to 10.5% of staff at the rural site, and 5.3% of staff at the rural supplementary site who had similar lengths of employment. While greater than 30% of staff at the rural supplementary site and more than 40% at the rural site had been employed by the same management group for more than ten years, at the regional site this was less than 10%. More than six years of continuous employment could be taken as indicative of being a long-term staff member. Thus around 55% of staff at the regional site

fitted this criteria, as did over 70% at the rural site, and nearly 60% at the rural supplementary site.

If the sample of interviewees was similarly representative of the demographics of the staffing at each site, this shows that the rural site staff were substantially more long-term and less mobile in the current workforce than those at the regional and rural supplementary site. Thus this might indicate a relative lack of economic opportunity at the rural site.

Consistent with the group demographics, the employment duration at the regional and rural supplementary site shows that the site management was made up of a mixture of relatively recently recruited staff (less than five years), and long-term staff. At the rural site the management team was much more stable (with two people interviewed six times), both of whom had been with the employer for over ten years. This tendency for there to be more long-term staff, at the rural site compared to the others was also seen for the RNs interviewed.

Tendency for longer term staff at the rural site was less marked for PCWs. One hypothesis is that due to the greater professional responsibility and slightly better pay, low care PCWs would generally be more experienced than those working in high care. This is indeed seen at the regional site. However at the rural site, low care PCWs were more recent hires. The majority of staffing at the rural site in low care was in the specialist dementia unit. The personality and attributes of staff required in the secure unit (where much care is psychological, and where sensitivity to mental disability is an important and valued attribute) may have been the cause of the greater proportion

of newer hires at the rural site. The reason for this would be due to a need to more carefully select staff with attributes more suited to psychosocial care over physical care.

Table 4.2: Employment duration by percent of sample at each site (top) and counts (bottom). Note that in both cases, double counting is possible as no attempt was made to take account of interviewing the same person twice

Employment duration (years)	Regional	Rural	RS
< 1	13.2%	2.6%	0.0%
1 to 2	10.5%	7.9%	5.3%
3 to 5	18.4%	15.8%	26.3%
6 to 10	47.4%	26.3%	26.3%
> 10	7.9%	44.7%	31.6%
Unknown	2.6%	2.6%	10.5%

	RSM	DRSM	LCTL	RN	EN	PCW HC	PCW LC	PCW Mixed	RAO	AH
Regional										
< 1		2	1				1		1	
1 - 2		1				2		1		
3 - 5	3			2		1	1			
6 - 10			2	3	2	1	6	1	2	
> 10						1	2			
Unknown								1		
Rural										
< 1				1						
1 - 2					1	1	1			
3 - 5				1		2	3			
6 - 10				3		1	4		2	
> 10		3	3	3	2	3	2	1		
Unknown						1				
Rural Supplementary										
< 1										
1 - 2							1			
3 - 5		3				1				1
6 - 10			2				2	1		
> 10				3				1	1	1
Unknown					1					

4.3 Qualitative demographic information

The job roles and employment duration of the staff interviewed for this research are the only readily available quantitative data, with complete, or in the case of employment duration, near-complete records. However there is further demographic information available about the career details of some of the staff interviewed. This is useful background information about the perspective and life experience that some staff bring to their job and can inform how staff view their own and others' computer skills. This latter information provides detail about the staffs' perspective on the END system and how they relate to it.

4.3.1 Career details of staff

The interview results suggested that RACH work is generally not a primary-goal career destination for RNs and Enrolled Nurses (ENs) who are likely to have had prior experience in the hospital system either in general nursing or mental health nursing. Two exceptions to this tendency were observed. Firstly there was one case of a manager who started as a PCW then went on to obtain professional nursing qualifications, firstly as an EN and was continuing on to complete RN training at the time of interview. The second case was of an EN whose mother was a site manager at the same site. The EN had been employed by the same management group as an EN for most of her working life.

A common theme for PCWs was that working in the RACH was a job they took on after a career break from bringing up a family. Experience in administrative

work or training in administration work, often using green-screen computer terminals widespread in the 1980s was also relatively common. A long-term desire to work in aged care was cited by one PCW, but more generally it appeared that staff had begun working in RACHs out of economic necessity. Despite the physically demanding, relatively poorly paid, difficult working conditions, interview participants frequently reported that they had an enjoyable and rewarding job.

There were clear indications that working as a PCW in low care is seen as a higher status job than a high care PCW. This seems to have been for two reasons. Firstly, in low care, working as a PCW requires higher qualifications (Certificate IV in Aged Care versus Certificate III). Secondly the work in low care is less physically demanding, being more focused on psychosocial support to help residents be as independent as possible, with a greater proportion of self-mobile residents to care for. By comparison, in high care residents are generally unable to perform most daily living activities.

That the data collection occurred outside a major capital city was significant. The ethnic make up of staff meant that there were very few individuals for whom English was a second language. At a city based facilities staff from non-english speaking backgrounds are far more common. One notable participant in my research was of a high care PCW who had come from overseas and retrained from a professional job (high school teacher) to work in the RACH. This person began to experience difficulties as the implementation went on. She noted the need to be discreet in the workplace about her tertiary qualifications – "I don't want to be known as a smarty pants". This mirrors my own experience as a new psychology graduate working as a

nursing assistant in inpatient acute psychiatry.

Secondarily, this person obtained significant gratification and career development from being a key individual in the train-the-trainer programme. When that ended and she returned to her normal duties, she felt under-valued and/or under-utilised in her workplace. This indicates a substantial problem with the lack of a career path for PCWs.

This problem of a lack of career path was being addressed by a Nurse Educator working in an RACH in another local management group that I had some involvement in during the data collection period. They used the presence of the computer systems to encourage and facilitate the most able PCWs to train as RNs or ENs. Contrastingly, the management group for my study sites did not seem to have a career development strategy in place. However, the possibility that the END could help with the provision of such a strategy was mentioned by some staff, especially RNs during the interviews.

4.3.2 Experience of care staff with computers

The requirement to use computers at work was long-standing for managers. Therefore managers were universally reasonably comfortable with the computer systems, and saw the new END as an extension of existing workplace information technology (IT) infrastructure. This is not to say that this was universally welcomed wholeheartedly. At the rural site there were a number of paper-based documentation processes to deal with care-planning or behaviour management that were difficult to replicate with the

END. In the case of behaviour management documentation it was not seen as possible to integrate into the END at all. However these paper-based workflows were highly successful and led one RN to state that the rural site's paper based system was "the best [paper-based documentation system] and the tidiest, the best organised that I have seen anywhere".

Professional nurses were also required to use the computer systems prior to the introduction of the END, to a more limited extent than the managers. However this varied substantially across the two sites. There was greater usage of computers prior to the END introduction at the regional site compared to the rural site. Because pre-implementation data were not collected at the rural supplementary site, information about the extent of prior experience with computers was not readily available.

At the pre-implementation interviews, it appeared that RAOs were extensive computer users, for planning and recording of recreational activities in the RACH. While some RAOs made attempts to integrate these existing workflows into the END this rapidly proved impossible given the design constraints of the END. See section 6.5.1.1 for more detail.

4.3.3 Self report of own and others' computer skills

When asked how long there had been a computer in their household for, almost all staff answered over ten years. A complete lack of computer skills was rare with only 4 staff (all PCWs) indicating that they had little or no experience of computers. However a common theme was that while their children and partner were regular computer

users, the person being interviewed was not. This finding broadly indicates that basic computer literacy was common. While staff generally possessed basic computer skills, at the initial stages of implementation these skills appeared under-utilised.

Nonetheless, this under-utilisation was far from universal. Many staff indicated that they used the computer at home for specific purposes (correspondence and household administration were the usual purposes given). When asked about their own computer literacy, (e.g. "how are your computer skills?"), the commonest answer, in over half of responses was "average". By contrast when asked about others' computer skills, there was a common perception that ten to 30% of staff had serious computer literacy issues requiring a significant amount of support to rectify. However the concern about a lack of basic skills seemed to be unfounded.

4.4 Staff's estimates of time to learn system

There were two questions in the interview guide that related to this item. Responses followed a pattern similar to that exhibited when interview participants were asked to compare their computer skills to others. Firstly, research participants were asked how long they thought it would take them to learn the system. Secondly (only in the later interviews) how long they thought it would take for the system implementation to be stable and well integrated into the workplace. Answers to the first question were quite variable, with responses ranging from "a couple of days" to around nine-months. The answer to this question about the amount of time to learn seemed mostly related to

individuals rating of their own computer skills, rather than the site training. Having said this, in the case of the rural site where there were some difficulties with the organisation of the training, the speed of implementation of new features (e.g. care planning) was seen to be slower and more difficult than at the other sites. This is covered in more detail in chapter 5.

The perceived ease of learning the system relates to the more organisational focused responses to the question of time to stability. At the rural supplementary site, the implementation was already seen to be stable by all staff at the second visit (18 months post-implementation). At the regional site, at the 18 month (final) visit, there were still minor adjustments in process, but otherwise the system was seen to be close to stability at the 12 month visit. At the rural site, opinion was more divided, with some staff feeling that organisational stability was another twelve months away after the final (18 month) visit, and others feeling that it was much sooner than that. However, at this site, there was a small group of staff at all levels who were very negative about the electronic system, stating that they did not like the software, and that it had failed to meet their needs. In the case of the manager who felt like this, her opinion was that the time spent working around the limitations of the END wasted a significant amount of time. By contrast at the regional site, the RSM was pleased with the way that she could re-purpose some parts of the software to provide new features (see section 6.2).

4.5 Broader Context and Conclusion

Due to the relatively low qualifications required for PCW staff and a more general historical lack of use of computers in RACHs, there were expectations from most stakeholders, of fairly strong resistance to successfully introducing an END. Some of the reasons for these expectations seem legitimate, for example the low educational qualifications of PCWs, and a relative lack of computer experience of most staff. However, these issues must be considered in the broader social context. That is, the expectation that computers are a significant part of daily working life is normalised in society. The web-browser as a mode of operating with computers has led to a style of user interface that most people have become used to over recent years (e.g. using internet banking). As well as this, the study time frame marked a period of time when mobile computing was undergoing enormous growth through the proliferation of smart phones, tablet computers and touchscreen interfaces. This created the perception at the end of data collection among some users that the END software had started to become dated, being described as "clunky" in comparison to more modern mobile web based platforms.

Thus it is important to note that while these demographics capture aspects of the group of staff that were interviewed, additional to this is the social context of the normalisation of IT in daily life. At this point it seems fair to say that the cohort of late adopters, such as would be many of the individuals interviewed in this study, are beginning to make more use of computers. IT is becoming more normalised in daily life at all levels of society, and non-computer users are beginning

to be seen as unusual. Thus, the issue of resistance due to computer illiteracy is becoming increasingly irrelevant. Nonetheless because end-users' exposure to different user interfaces and system capabilities may place more demands on software vendors with respect to ensuring user experience properly reflects expectations.

Chapter 5

Stakeholders, Contexts and Study

The first half of this chapter describes the operating environment of the Residential Aged Care Homes (RACHs). It begins by examining the key stakeholders, the industry structure and the regulatory environment. This is followed by an examination of the roles and broad perspectives of staff at different organisational levels, from executive managers Personal Care Workers (PCWs). This discussion helps us to understand how staff relate to computers, and their expectations as to what the introduction of an Electronic Nursing Documentation (END) can bring.

The second half of this chapter examines this contextual information to provide a comparative description of the different outcomes at each site. The way the Train the Trainer (TTT) programme was implemented, in particular the differences in the perspectives of the managers, and operational issues like staff turnover, and the pace of training seemed particularly important. Resistance to using the system seemed greatest at the site whose pace of training was slowest. Training was better organised

in sites where the concept of the need for change was greatest. Frequent repeated use of the system by most staff seemed to lead to a cohort who grasped improvements afforded by the END more readily.

5.1 Stakeholders

For the purposes of this discussion, primary stakeholders are defined as individuals and groups that have immediate concerns with the RACHs' day-to-day operations and who are employed in the RACH sector. The purpose of this section is to summaries the key concerns of each group of stakeholders with respect to their relationship to the RACH and the management group.

5.1.1 Executive

The management group under study is a not-for profit entity with around 35 years of history of operating in its region. As with other management groups in the aged care industry, they provide the infrastructure and management support for a range of aged care services. These mainly comprise residential aged care services, community care and respite services, and supported accommodation for old people who are mostly independent living but require some extra support such as help with the cost of accommodation, or low intensity monitoring of everyday living. My research is exclusively concerned with the RACH services of the business. These concern people

with medium to high dependency caused by old age [1] and certain levels of disability.

The structure of the executive management group reflects its major operational concerns. The five individuals on the board are the Chief Executive Officer (CEO), and the following executive managers: finance and administration, human resources, property and sustainability, residential services, and community services. Of these, the key actors with respect to the END implementation are the CEO, the executive manager of residential services, and the finance and administration manager.

Two features of the organisation of the executive management team are worth noting with respect to the implementation of the END. Firstly, the community services arm of the management group were not directly affected by the implementation of the END, as neither was the property and sustainability division. Thus, the implementation did not have an effect on the entire activity of the management group. Secondly, information technology (IT) does not have a direct representative on the executive management team. This indicates that information systems are not a primary concern of the businesses operation.

The executive management team are generally focused on long-term concerns. Examples of these are: ensuring regulatory compliance, the provision of high quality care, responding to demographic changes within the management group's catchment area, and ensuring the long-term viability of their operations.

The management group under study is a not-for-profit entity. Thus, issues sur-

[1] The majority of residents are over eighty, although health problems caused by lifestyle or genetics mean that residents in their 60s or older are reasonably common. Rarely, young people (meaning of working age in this context) can be cared for in RACH facilities, usually due to severe neurological impairment.

rounding major changes to the operation of the RACHs such as the introduction of the END can be expected to have longer-term consequences than for a commercial entity in this sector due to the increased longevity of non-profit aged care organisations compared to for-profit (see section 5.1.2). According to two interviews with the management group's CEO in 2009 and 2010, the finance and administration division drove the implementation of the END. Their aim was to "streamline labour costs so as to create better data to support funding claims" [interview with CEO]. That is, a primary aim was to maximise funding via the provision of a computer based workflow that maximised efficiency and effectiveness.

While initially there were high expectations of decreasing labour costs by reducing the burden of documentation, it was acknowledged that this had not occurred. So although these immediate labour efficiency gains were not realised, the END was seen by the executive to improve the documentation workflow, thus improving effectiveness. These improvements were perceived as having great significance due to demographic changes among the client base of the RACHs. The demographic changes were caused by regulatory changes implementing an 'ageing in place policy' discussed in section 5.2.1. This policy has resulted in higher dependency clients in low care, which in turn has caused an increase in documentation workload. However the improved workflow was perceived to offset this increase.

Having provided an overview of the perceived consequences of the END on day-to-day operations from the viewpoint of the CEO, the other important context from the point of view of the management executive was the way that computer hardware

and software were procured. The best way to describe this selection process was with an extended quotation from the second CEO interview transcript:

> We considered three [different products]. The decision was made to use [the chosen product] as we had partnerships with a management group in Western Australia. We purchase their building designs, care systems and their financial model. Through that partnership we learned that they were assessing electronic care systems at the same time [as us]. They put us in touch with an organisation close to them, and their Chief Financial Officer (CFO) and our CFO agreed to exchange information. We helped them with some [unrelated] things, and they showed us the scope, the tender and the proposals that the three companies had put to them, and the way that they had assessed those proposals. So we used that information to see if our scope was similar, contacted those companies to see if their proposals would be similar for us, and then had a presentation from each of them, and then we [made the choice]. So we weren't hands on with the software. We based the decision on the fact that all three systems had been implemented in many major non-profits across Australia. The decision was made by administrators and support services leaders, basically on the assumption that [the chosen product] was more flexible than the other two, and that our existing care formats could be incorporated into it to make the transition from the paper to the electronic system much less traumatic for staff.

As well as software procurement, the management group also had to update the IT infrastructure in order to provide workstations for care staff. The finance and administration managers made the decision to use network-based thin client terminals backed by remote storage and application server infrastructure from a data centre in Sydney. This style of infrastructure roll out was done to contain hardware and maintenance costs. During the time the research was conducted, with the exception of one or two machines in the IT support unit, all computers were these thin client units. This is interesting as although the business was self-described by the CEO as a very conservative organisation in a conservative sector, this thin client, network computing based approach indicates a forward-thinking attitude to IT infrastructure. In a sense, the management group were unknowingly an early user of, and advocate for 'cloud computing' (Armbrust et al., 2010).

As part of understanding the implications of this infrastructure I made my own investigation into the potential network speed of the management group's IT system. This suggested that as the research started, bandwidth provision was around the minimum acceptable level for the thin client infrastructure in the early days of the roll-out (i.e. there was little headroom). This did get better with improvements to Assymetric Digital Subscriber Line (ADSL) – low performance broadband internet technology over copper telephone wire – technology during the course of the study. With the probable eventual deployment of the fibre-to-the-premises National Broadband Network, the use of thin clients will be a cost-effective and future-proof choice of infrastructure.

5.1.2 Site-managers

The site-managers job titles were Residential Services Manager (RSM), Deputy Residential Services Manager (DRSM) and Low Care Team Leader (LCTL). These staffs' professional backgrounds are usually Registered Nurses (RNs), although RSMs in some homes come from a health administration background. Two of the six LCTLs interviewed were Enrolled Nurses (ENs), although due to the change in low care towards a more high dependency client group there was an effort being made to move away from the use of ENs in this position. The RSM is responsible for the overall operation of the site and reports to the executive management team. The role of the RSM is largely administrative, ensuring the smooth running of the RACH. Of the site managers, the RSM is probably least affected directly by the introduction of the electronic system.

One example of improved workflow brought up by an RSM was the introduction of a web services based funding mechanism. Secure funding helps secure the operation of the home. Handling of the funding related information (largely timetabled clinical assessments and medication information) was largely the job of the DRSM or a delegate. Other examples of benefits of the END for the RSM were improved appraisal of care staff documentation compliance – a feature used to different degrees at each study site; a more streamlined admissions procedure; and the improved ability to look up information during interactions with family members due to having access to all notes from the RSM's office.

The DRSM's role generally involves more hands-on care than that of the RSM.

The RNs and LCTL report to the DRSM. The DRSM is usually responsible for collating and submitting funding applications, using data collected by RNs in high care, and the LCTL (and their PCW delegates) in low care. As a result of this intensive usage of the system, the DRSM, with the exception of the Regional site, had a much closer engagement with the implementation of the END than the RSM.

The LCTL is perhaps the most intensive user of the END system, being the care coordinator for all low care residents. This means that compared to other RNs the LCTL's case load is much higher due to being responsible for performing assessments, reviewing care plans, and otherwise maintaining the documentation required to support care and resident funding. So while the LCTL have administrative and managerial components to their job in common with the DRSM, the LCTL also has a more substantial role in provision of direct care. As a result, when the END is perceived to support administrative functions at the expense of care related functions, the LCTL may develop a conflicting attitude to the system. An example of this is discussed in section 7.4.

The changes in demographics resulting in the previously mentioned increase in dependency of low care residents affected the site managers in two ways. Firstly, the site managers are the major beneficiaries of the improved workflow from the END. That is, the reported increased documentation load is offset by the improved information flow caused by the END. Secondly it eases their day-to-day concerns with respect to recruiting and retaining suitably qualified staff. The second effect helps cope with the potential consequences of maintaining adequate staff ratios in an environment where

the amount of work required per resident is increasing. This is especially an issue in situations where the funding model may not match the amount of work required, as may be the case in specialist dementia low-care units.

5.1.3 Professional nurses

Based on the interview data, it appears that the professional nurses (RNs and ENs) were among the least experienced of the research participants with computers. ENs are Technical and Further Education (TAFE) – further education – diploma trained with a substantial practical component, and in high care work under the supervision of RNs. ENs working as LCTL require the support of RNs for some tasks. RNs trained prior to the introduction of the university curriculum in the 1980s and 1990s were generally trained through placement-based learning in hospitals. At the end of training they would obtain a certificate in General Nursing. Over the course of the 1980s, this type of registration was phased out, and RNs were then trained to diploma or degree level through the university system. Only one professional nurse interviewed for this research met this criterion – and this was an RSM who had trained as a nurse as a mature aged student in the early 1990s. One LCTL was an EN in the final stage of a part time nursing degree to become an RN. The remainder of RNs were trained under the old system, indicating the relatively old age of this cohort. Data from a questionnaire survey which was collected in the research sites before the introduction of the END (Yu et al., 2009) suggests that the majority of registered nurses working in the RACHs were over the age of 50. Due to sampling differences the questionnaire data

was not directly comparable to the interview sample. A qualitative comparison to Eley et.al's 2006 survey of demographics and computer experience among the Australian nurse population suggests that the cohort of professional nurses participating in my research were older than the average Australian nurse, thus were more likely to have limited experience with computers.

This placed the nurses in an interesting situation. As well as being less experienced with computers than many of the PCWs (see section 5.1.4), they were also the biggest users of the system. They were required to use most aspects of the system including some of the management reporting features.

Another demographic difference between the interviewees and the nursing profession as a whole (Eley et al., 2006) was that the staff at in the study sites were overwhelmingly female. Only one male RN was interviewed. This suggests that males in RACHs are under-represented compared to the profession overall – although nursing is female dominated (Eley et al., 2006).

5.1.4 Personal Care Workers

Personal care workers are generally trained as Certificate III or Certificate IV care worker in aged care delivered by the state further education college. High care is where PCW's duties are more restricted and the physical demands of the job are high. These staff are mostly Certificate III qualified. In low care (including secure dementia care) it's a requirement that PCWs are Certificate IV qualified. The prerequisites for a Certificate III and IV qualifications are for compulsory secondary school education

only.

Nonetheless, the career histories of PCWs are quite diverse. Prior work to entering aged care meant that there were many PCWs with significant computer experience from working in office administration. An initial experience of computers using green screen terminals as a part of administrative work in the 1980s or earlier was relatively common. Other examples included a former librarian, retail workers and customer service workers. Aged care seems to be destination for women later in their career – for example for stay-at-home mothers returning to work after their children had grown up. As with professional nurses, only one male PCW was interviewed, and this was a specialist night shift worker at the rural site.

The change in government funding regime from the Resident Classification Scheme (RCS) to the Aged Care Funding Instrument (ACFI) in 2008 had caused substantial changes to the documentation workload of PCWs. This was especially the case for high care PCWs. For these staff, documentation tasks had changed from a requirement for at least weekly progress notes to an exception-based reporting system. Objective reporting requirement of care like bowel movements and assistance with self-care were unchanged between the two systems.

This change to the documentation regime is distinct from the workload implications of the ageing in place policy mentioned previously. The actual effect was to substantially reduce high care PCWs documentation workload. However, PCWs in low care were required to conduct and document a broader range of assessments under the support of the LCTL or a high-care based RN under the new system.

5.1.5 External stakeholders

With the exception of one visiting physiotherapist who was interviewed with her assistant at the rural supplementary site, external health providers were not part of the interview sample. However they were frequently the topic of discussions during interviews, particularly the visiting doctors, and the impact of the system on medical visits. Local variations in practice caused substantial differences with how the RACH coped with integrating the END into visiting doctors' documentation. This topic is discussed in section 7.12.

5.2 Industry context

5.2.1 Regulation

The 1997 Aged Care Act (Commonwealth of Australia, 1997) provides the governance framework for the operation of RACHs which itself defines the set of objectives that aged care in Australia should meet. However the usual reference source used in aged care for understanding the regulatory environment is the Residential Care Manual (Commonwealth of Australia Department of Health and Ageing, 2009)

The principles of the Aged Care Act are:

- Promote high quality accommodation and care
- Protect the health, well being and rights of residents
- Ensure the accessibility and affordability of care

- Plan for effective delivery of care
- Ensure appropriate funding and targeting of services
- Encourage an appropriate flexibility and diversity of services which is responsive to individual needs
- Ensure that funding accounts for the quality and level of care
- Provide respite for community carers (e.g. family members)
- Promote 'ageing in place' – that is helping old people stay where they want to live.

As noted previously, the final principle of 'ageing in place' has lead to the increase in dependency of residents in the low care environment and thus the increase in documentation load on low care staff that was noted by the CEO. In terms of the other principles, the END system has the potential to help promote the quality of care and protect residents' well being through improved workflows and streamlined communication channels. Due to the availability of aggregate data, and web service based funding submission process for funding applications, the END could also promote efficiency in this area.

Around 70% of the funding for residential aged care is provided by the Commonwealth Government (with the remaining 30% coming from various kinds of resident contribution). Thus, funding is for ensuring adequate resources are available. The regulatory environment was supported by an accreditation process which was overseen

by the Aged Care Standards and Accreditation Agency. This is a limited company 'owned' by the Commonwealth Minister for Mental Health and Ageing.

The accreditation requirements stipulate that RACHs who are in receipt of government funding must meet the accreditation standards as assessed by the accreditation agency. The accreditation standards are divided into four areas, which are defined in the Quality of Care Principles. These are divided into four groups:

- Standard 1 – management systems, staffing and organisational development
- Standard 2 – health and personal care
- Standard 3 – resident lifestyle
- Standard 4 – Physical environment and safe systems.

All standards emphasise continuous improvement. As such the improved workflows and access to data that the introduction of an END can provide has the potential to facilitate continuous improvement for any information-centric part of the operation of an RACH. However this is an indirect connection between accreditation and the END implementation.

The END has an influence on at least three parts of the accreditation standards. Firstly in Standard 1 :"Effective information management systems are in place". Secondly, the END's security and privacy safeguards are related to the resident privacy item in Standard 3: "Each resident's right to privacy, dignity and confidentiality is recognised and respected". Thirdly in Standard 4: "management and staff have appropriate knowledge and skills to perform their roles effectively" (Commonwealth of Australia Department of Health and Ageing, 2009, pp. 54-56).

Non-compliance with the accreditation standards is a serious matter, and can result in the appointment of an administrator and a freeze on taking in new residents while issues are dealt with. In extreme cases non-compliance with the accreditation standards can result in the closure of a home.

5.2.2 Structure of the residential aged care sector and its relation to software vendors

Over 60% of the residential and community aged care sector in Australia consists of not-for-profit facilities, either run by religious organisations, charities or community groups (Australian Government Department of Health and Ageing, 2010). Of the remainder, 34% of the sector is run by for-profit organisations, and the remaining 6% by government homes. According to the CEO of the study management group, as well as being the dominant providers of RACHs, the longevity of the not-for-profits is much greater than the for-profit sector. RACHs in the for-profit aged care sector change hands on average more frequently than once per decade. By comparison the age of the study management group (a community organisation) of around 35 years is fairly typical for the not-for-profit entities.

On the face of it, this would appear to have little relationship with the implementation of the END. However, the fact that the industry sector is dominated by long-term presences suggests that for a successful vendor the rewards of providing an END can be quite high with respect to generating a long term revenue stream. This is especially true given that once an information system is thoroughly embedded into

an organisation, it can be impractical to replace.

5.3 Study Sites

All three of the study sites were located in South-Eastern New South Wales, Australia. Both the rural and rural supplementary sites were newly built RACHs on green field sites. The regional site was a substantial extension to an existing low care facility at the same location as the management group's head office. As indicated in section 5.1.1, the architectural designs of the homes were purchased from a Western Australian aged care management group, although as with any other building project there were significant local variations to the layout of each site. Details about the number of residents, the division into high- and low- care and the related information about these variations are given below.

Staffing levels are based on legislated requirements regulated by the Aged Care Act (Commonwealth of Australia, 1997). In high care, one PCW looks after seven residents. In a secure unit, the ratio is one PCW per 10 residents; in low care it is one PCW to 25. Therefore the absolute number of staff at each site varied according to how full the site was during each field visit.

At all three of the study sites, all residents were housed in single-bed rooms. This represents a shift from older RACHs where dormitory style accommodation is the norm. New RACHs are not built with dormitory accommodation, and older dormitory style homes are generally in the process of either being refurbished or sold for

redevelopment.

In Australia, high care residents are those identified by government assessors as needing comprehensive assistance with most daily living activities. Low care residents are those in need of services including meals, laundry and cleaning, and some additional help with personal care (Productivity Commission, 2011). The secure unit houses mobile, low care residents with severe behavioural problems such as those caused by dementia. If low care residents' condition deteriorates so that they are no longer mobile, they will be moved to high care. The implementation of the END at both the regional and rural sites required transitioning from the pre-existing paper system to the electronic system. The rural supplementary site was a green-field site, which had no previous paper system, and thus its implementation approach was somewhat different (detailed below).

5.3.1 Regional site

During the pre-implementation data collection visit and the six-month follow-up, the regional site was running well beneath capacity. Consequently the RSM was actively recruiting respite admissions – short term, self-funded admissions of up to a month's duration, but usually of around a week or two. This created a substantial administrative load surrounding basic data collection as it increased low care resident throughput substantially. Although respite admissions are not covered by the Aged Care Funding Instrument, there is still a regulatory and clinical need to perform baseline assessments (a subset of the ACFI). Staff also need to establish a relationship with the

respite residents, so the administrative and care work load were significant.

At the regional site, over the course of the data collection, there was significant turnover of the LCTL in that at each data collection visit the LCTL was a new member of staff. Some stability had been obtained for the position at the final visit by recruiting the DRSM from a smaller high care only site which was part of the same management group. At the pre-implementation visit, the acting LCTL was an EN who had been employed by the management group for over ten years. She was covering for the position while recruitment was under way. At 6 months a new RN from outside the management group had been recruited to the position. However this person only stayed in the job for three months, apparently due to not liking the much larger-scale environment compared to her previous work. At the final visit, the acting LCTL from the first visit had been given the job of Documentation Officer. She was responsible for much of the collation of assessments, and preparation of information for submission to the funding body.

The physical layout of the facility was that both the low care and high care units had one nurse's station, with an additional office for the DRSM and LCTL placed equidistant from the low care and high care nurses' office. The RSM had a single office placed behind the front reception desk at the main entrance of the home. There were suggestions from some staff that the layout of this site compared to other sites tended to isolate the site managers from the care staff. That is, the relative lack of proximity to the parts of the home where direct care was conducted was seen as a problem by some.

Prior to the implementation of the END there had been a near-miss failure during the previous accreditation exercise at the regional site. Failure of accreditation is a serious problem and results in much closer oversight of the RACH's activities, and if improvement to meet the accreditation standard is not met, potential closure. Thus the conception of the need for change (see section 2.7) was high at the regional site.

5.3.2 Rural site

Unlike the regional site, the rural site was operating close to capacity from very early on in its operation. This was due to it replacing two older facilities under the same management group (a high care and a low care facility). It also seemed that the additional capacity was easily filled due to less local competition for residents between RACHs than existed at the regional site.

The layout of the site in terms of nurses' stations and offices was similar to the regional site, with the exception that the LCTL and DRSM had separate offices. These offices were closer to the high and low care units respectively than the single office that housed these staff at the regional site. There were two nurse stations in the high care unit, and one nurse station in the secure unit, which was much busier than in the regional site. Correspondingly the general low care unit at the rural site was much smaller than at the regional site.

The suggestion that the management staff were isolated from the floor staff was absent at this site, unlike at the regional site. As with the regional site, the implementation of the END was based on moving from the pre-existing paper system adapted

from that at use at the sites that were closed down to the new electronic system.

The LCTL and DRSM had the majority of responsibility for collating and maintaining the documentation for ACFI funding assessment at the rural site, with much less delegation. There was no dedicated staff member for this task as was the case at the regional site. Having said this, there was one RN in the high care unit who had informally taken on a great deal of the documentation coordination role. This person was often selected to be acting DRSM when the RSM or DRSM was on leave – in the former circumstance the DRSM would act up to the RSM role.

The existing paper system at the rural site was highly regarded by staff. This strongly suggests that the conception of the need for change of documentation system was much lower at the rural site than at the regional. In other words, unlike at the regional site, there were few or no pre-existing documentation problems.

5.3.3 Rural supplementary site

As with the rural site, there was no suggestion that staff and managers were isolated from each other in the way that was suggested at the regional site. As the supplementary rural site was a green field site in a relatively remote location, there was not the opportunity to manage the gradual increase in the number of long-term residents through the provision of respite services. Neither was there the opportunity to move residents from other facilities, which was the case with the rural site.

Unlike the other two sites, the electronic system was introduced immediately as the site was opened. There was no pre-existing paper system to replace. While the

staged implementation model was still used, the number of people using the system was much lower as initially only RNs and ENs were to use the system. Later as the low care unit opened up for residents, the low care PCWs started using the END. Thus while the features of the END were introduced in a staged way, due to the lower number of users initially, the features were staged more quickly. Secondarily to this the introduction of the END to the full range of end-users was more gradual than at other sites, suggesting a staged-user model of introducing the system where instead of introducing all staff to features over a slow period of time, a small number of staff were introduced to a greater range of features more quickly.

5.4 Training approach, and implementation strategy

As mentioned in section 3.2.2 the introduction of the END was staged with features being introduced over a period of time. Local variations on how the staging occurred, especially at the rural supplementary site, which were described above. In order to achieve these, the management group used the vendor's recommended TTT model. That is, a vendor representative at each site trained ten TTT trainers including three managers. The managers themselves were not expected to provide the training to the floor staff. This was expected to be the job of RNs, or more usually PCWs.

It was common practice to use workers undergoing rehabilitation for work-related injuries (known in Australia as Workers' Compensation), as a way of managing the

staff resources. For example back injuries are relatively common among PCWs, which while being treated render them unfit for many normal duties in the home. This is common enough that for homes the size of the study sites, the presence of one or two injured workers at all times is normal. Under the workers compensation legislation, the employer is required to return the employee to regular work ("suitable duties" – duties suitable for a person with such an injury) as soon as practical after injury in order to encourage rapid return to work. Thus, injured PCWs were likely to be used as TTT trainers. At the rural site, the sole/main trainer was an injured worker, as was at least one trainer at the regional site

Unfortunately it seemed a matter of luck if these injured workers' were the most suitable trainers for the job. While at the regional site it seemed that of the seven TTT trainers, three became the core trainers to cover the entire site. At the rural site, only one TTT trainer provided training for the entire site. This caused significant problems with training coverage, detailed below. At the rural supplementary site, the TTT trainers were not immediately responsible for training other site staff, as the staff who received TTT training were initially the only staff using the system. The number of staff using the system only increased slowly.

While the managers at either site did not explicitly identify training issues as an implementation challenge, they were clearly a very significant issue at the rural site. Although a substantial number of people at both sites reported that they did not need training, and that learning how to use the software was straightforward, the vast majority of individuals at the regional site received training (at least 90% training

coverage). This was compared to at the rural site where only approximately 60% of care staff received training.

The results from staff opinions about training at the regional site were quite straightforward. There was unanimous agreement that the training process went well and met their needs, with no obvious issues that would result in improvements to the training process. Participants perceived that the need for on-going training was being met satisfactorily. It appeared from the discussion with managers and professional nurses that the training regime was well organised, and structured to maximise coverage in as short as possible amount of time. The only real weakness with training from TTT staff was the fact that there was more of a focus on extracting management data, rather than training on recording data in the system.

There were two main reasons why training coverage was so much lower at the rural site. Firstly there was significant staff attrition. Three of the 10 trainers left their employer prior to training commencing. Secondly with accreditation occurring at the same time as the training stage of pre-implementation only one of the seven remaining trainers was available to provide training for staff during this period. She reported that staff's compliance with booking and attending the scheduled training sessions was quite poor. That is, it was possible that she did not have sufficient support to ensure training coverage from the site managers.

As previously noted, a small but significant number of interviewees indicated that they were able to teach themselves how to use the documentation system, and so their training needs were minimal. This sub-group reported that they were happy with the

way that training was performed on site.

However at 6 months and 12 months, the need for on-going training was mentioned as a problem by many staff. The consensus seemed to be that this need was not being met sufficiently at the rural site. This issue may have been partly caused by the lack of proximity of support staff from head office. However it seems likely that the organisation of training with complete training coverage and committed support from the site managers was a significant factor respecting to the training satisfaction.

There were suggestions that the training process did not go as smoothly as would be desirable at the rural site. The LCTL at the rural site suggested that the training process could have commenced sooner after the TTT sessions had completed. There was a long (three month) delay between staff training and the initial implementation, and that there were problems with retaining the availability of TTT staff. Thus it seems that many of these problems could have been avoided if the site managers and head office had been aware of the problems with training provision and the delay at critical stages of the implementation time line.

The final problem with the rural site was the delivery of TTT training. There were a number of comments from staff who had participated in these sessions that they were unhappy with attitude and engagement of the vendor supplied trainer. Specific examples were that the vendor trainer was frequently late during the week long training session, was seen to be disorganised and took frequent breaks. A poorly located training room, and teething problems with the new IT infrastructure also complicated the TTT training.

These issues together strongly suggest problems with the management of training at the rural site comprising factors that were both within and outside the control of the site management. The location of the training room was also a concern expressed at the regional site, but it did not seem to impact heavily on the TTT trainees overall opinions of the training.

5.4.1 Influence of head office

As previously mentioned, a big difference with training and support at each site was the difference in proximity to the management group's head office. With the head office, and END project manager and IT support staff physically available to the regional site (a very short walk away), there were strong feelings that on-going support was excellent, and met the needs of the unit very well. At the two rural sites, due to the 90 minute to two hour drive from the head office to the site, it's clear that on-going support was more restricted. Supplementary training had to be provided on a structured basis as the opportunity for ad-hoc face to face support from the head office was absent. However, the issues relating to training coverage, and on-going support seemed to be viewed in the same way, or a slightly more positive light at the rural supplementary site, than at the regional site. Concerns seemed strong and persistent at the rural site. At the rural supplementary site, the positive sentiment may have been due to the smaller number of people required to use the software, and the DRSM's excellent knowledge of the system and clear vision of how it should be used.

A follow-up conversation with the END project manager suggested that although the rural supplementary site's slow implementation staged by number of users was a helpful, low risk way to ensure that the END was implemented in a reasonably trouble-free way, it was not without problems. At around 3.5 years post-implementation, there were still concerns in the management group that too many care staff at the rural and rural supplementary site staff did not know how to use the system. This had been being rectified by more ongoing training starting around three years post implementation.

5.4.2 Comparison of sites

The causes of poor training coverage, and why it was a problem at the rural site were clear. Due to the requirement that all care staff used the system at least for incident reporting and exception reporting in progress notes, and the incomplete training coverage, all staff needed to make minimum usage of the END. However the incomplete training coverage did not allow this.

The reasons why this was a problem at the rural supplementary site were more subtle and related to the regulatory requirements. That is, according to the Aged Care Act (Commonwealth of Australia, 1997), the person who made the observation about care in an RACH should be the same person who made notes in the documentation. When there are only a very small number of staff looking after a small number of residents, this is not a problem. However in order to meet these regulatory requirements in a larger scale environment, it is necessary to train all care staff. This is because they are the staff members who interact most with residents on a daily

basis, and know their personal needs, and any changes in those needs. Therefore the risk of care needs being missed would pose higher risk to residential care, which may cause problems with meeting regulatory requirements.

5.5 Resistance issues

The role of resistance following the introduction of changes in organisations is an important part of the history of a change programme's introduction, and thus has an influence on the trajectory of change (Pettigrew, Woodman & Cameron, 2001). As such, the development and resolution of resistance to change over the study period is discussed in this section as an important contextual feature of the environment. At the regional site, the site manager indicated that resistance was very easy to deal with. Compliance with the new documentation system had been integrated into staff's performance appraisals. Floor staff of all levels who under-utilised the documentation, or documented incorrectly were individually counselled. Care staff interviewed noted that initial resistance was easily identified and overcome by frequent repeated use of the system. Motivation to use the END system to full effect was also very strong at the site due to the strong conception of the need to change.

Accreditation failure creates an increased administrative burden, general uncertainty and financial insecurity (i.e. resident recruitment freeze). The near-miss at the information systems accreditation component at the regional site (see section 5.3.1 would have created high levels of motivation among managers and care staff in the

home to improve information systems.

By contrast, at the rural site resistance seemed much more widespread. Although reporting of their own resistance was rare, the rural site trainer noted that a number of people who had not participated in the training had "slipped through the cracks". The interview results also suggested the strong possibility that a significant number of PCWs could avoid using the system by delegating documentation tasks to other care workers. The rural TTT trainer also observed a small number of people who were "shy to use the system" at 12 months post-implementation. This trainer also observed that although people with little or no computer experience were often initially apprehensive, if they used the system for a relatively short period of time, their apprehension was overcome. They tended to come to the view that "it's not as bad as everybody thought it was". This suggests that much of the problem with resistance was due to a lack of experience with the system. Where the system was used less heavily as in the rural site, the collective experience increased slowly therefore resistance was maintained for longer.

At the regional site, staff who were inexperienced with computers indicated that frequent repeated use of the system, as mandated by the RSM and her team overcame their apprehension with the system. This helped them to change negative attitudes, for example, fear and lack of confidence. This frequent repeated use of the system was achieved through the use of a range of clinical systems, especially for high care PCWs. These included through the use of the electronic bowel charts (see section 7.2). This usage may not have been a good outcome due to user interface design problems

discussed in section 6.5.1, section 6.6, section 6.5.1.3, section 7.5 and section 7.8.

The interview participants indicated that the combination of good quality comprehensive training, and the requirement to make frequent repeated use of the system created an environment where staff were enthusiastic about the introduction of the END. The opportunity for frequent repeated use by the high care staff at the rural site were much more limited as the computerised bowel charts were abandoned after a short trial during the very early stages of introduction of the END. The problems with training coverage, and the lack of requirement for daily use of the END provide a partial explanation for higher resistance at the rural site than the other two sites. However, this did not provide full explanation for the increased resistance. The commitment of the management, and their perception of how well the END met the clinical needs were also potentially an important driver. These issues are covered in more detail in chapter 6.

The approach taken at rural supplementary site is an alternative method that distanced the high care PCWs from the documentation system. This allowed the build up of an exclusive network of care staff with higher status due to exclusive access to the END. Limiting who was affected by the implementation, at least in the initial stages of the implementation seemed to be a potentially sensible approach to manage workload. For a green-field site, this may be a more efficient way of ensuring, strong initial adoption of the system. However as noted in section 5.4, this approach is not without regulatory risk if the system is not extended to the whole care team.

5.6 Conclusion

In this chapter, the key stakeholders were identified, along with an outline of how their relationships to the RACH institution situated their perceptions towards implementation of the END. The management group provided the impetus for rolling out an END and set the implementation strategy. However, because site managers were given a reasonable level of autonomy to decide the scope and pace of implementation, this resulted in significant local variations in the implementation of usage of the END among sites.

It's not clear that it's possible or desirable to avoid significant local variations. For example local variations in conditions with respect to staff literacy, English language skills – more of an issue in city locations than in these study sites – and local economic features such as the availability of other employment are all important aspects to take account of when planning for change implementation.

There were two issues, which emerged from the interview data as particularly important contextual features that differentiated the three study sites – the training process, and the trajectory of resistance to using the END. From the descriptions above it seems that the implementation at the rural supplementary site was the most straightforward. Here there was a clear vision for how to implement the system from the DRSM (staged-user model, rather than staged-feature at the other site), and a green-field environment where there was no previous paper system. However the problem of resistance of users to the END was replaced with having too many non-users.

Because of the pre-existing paper system, the implementation at the regional site was more complicated due to the presence of old paper based records. However strong commitment from management, a well organised training programme, and a situation that motivated a strong need for change ensured that the system embraced whole-heartedly by the care staff.

At the rural site. It is possible that due to the high quality of the existing records system – confirmed with field observations – that the need for change was not strongly perceived by the site managers. The poor timing of the initial TTT training and the clash of its introduction with accreditation were other significant, possibly related problems. In combination with the coincidence that the vendor trainer was not highly regarded by the staff receiving TTT training and the attrition of TTT staff, this created further problems. The result was that training coverage was low, features that were not easy to use were abandoned quickly, and staff's engagement with the system was relatively low.

Chapter 6

Users experience with the electronic health record

6.1 Summary

Much of the interview guide was designed to gather information on staff's experience with the introduction of the Electronic Nursing Documentation (END). To this end, the major questions were those which related to the perceived benefits, and problems with the END. The chapter is structured such that the site managers' attitudes to and experiences of the implementation is discussed first. This is followed by a more general discussion of the care staff's perceptions of the benefits and drawbacks of the END system at each site.

6.2 Managers' attitudes to implementation of the system

After the organisation's decision to implement the END was made, the site managers drove the implementation, and were given significant administrative power to make 'local variations' in the strategy and pace. Implementation strategies were contingent on their beliefs as to how the introduction should be organised and presented to the site. Thus site managers strongly influenced the foundation of the attitudes, beliefs and experiences for other staff at each site.

The site managers' general attitudes to implementation were different between the study sites. Different styles of leadership and different levels of control of implementation of the END were displayed at each site. The rural supplementary site management is discussed first, as the most straightforward successful case. Next, the regional site, as a successful yet more complicated case. Finally the rural site is discussed, as a complex, but less successful case. This will highlight the differences between the management and leadership at each site.

The rural supplementary site, as a 'green field' site, seemed to have the most straightforward initial END implementation. The approach taken here was highly targeted. Only professional nurses were required to use the system at initial introduction. Personal Care Workers (PCWs) were discouraged from using the END at all. In the low care environment there was a gradual introduction. This meant that all aspects of the introduction of the END were very much under the control of the

Deputy Residential Services Manager (DRSM) with users only using the system on an 'as needs' basis. The DRSM at the rural supplementary site had a clear vision in which the introduction of the END would provide improved oversight, especially for monitoring clinical indicators. A strong and organised leadership approach was also demonstrated by the fact that the DRSM had exerted significant effort to ensure that visiting doctors had easy access to their existent clinical information systems. This enabled the smoothest possible integration of doctors information technology (IT) systems into the END workflow at the Residential Aged Care Home (RACH) (this is covered in more detail in chapter 7). The approach of the DRSM to the introduction of the END is encapsulated in this extended quote from the 12 months post-implementation interview:

> We changed [who was responsible for documentation] even in the old paper system [at the older sites that the green field site replaced] because when we had documentation that was accurate for both accreditation and assessors of funding, the nursing documentation wasn't up to grade and you could lose funding – and you could lose accreditation grades because of poor documentation. So if you limit who is doing documentation and you ensure they are trained in what they are writing, you ensure a better, tighter system.

At the rural supplementary and rural sites, the leadership of the END introduction was clearly seen to be the responsibility of the DRSM. In many respects, this makes sense as the DRSM generally leads the clinical care aspects of each RACH, and

much of the purpose of the END is to support the administrative aspects of aged care services. However, the Residential Services Manager (RSM) generally has the ultimate responsibility for staff appraisal and discipline, the RSM has considerable power in the home, which can be used to persuade staff to be enthusiastic adopters of the END. This may have been what occurred at the regional site. Excepting a brief conversation with the RSM of the rural supplementary site at the final visit, the two RSMs at the rural and rural supplementary sites were not available for interview during data collection. The DRSM was readily available at both of these sites at all visits. By comparison at the regional site, the RSM was the first person that was interviewed on all visits, and their enthusiasm for the introduction of the END was very clear.

The much improved funding application mechanism (discussed in section 7.2), and easier access to resident notes was obvious to all of the managers interviewed despite the reservations of the rural Low Care Team Leader (LCTL) which are detailed later in this chapter. However the regional site RSM's interest in the system went above this. Firstly this manager was enthusiastic about the large improvement in the ability to monitor care staff's documentation compliance. This was noted as a possibility at other sites, but my impression was that using the END system as tool for compliance monitoring may not be as widely used.

As well as the improved oversight of staff's documentation activity, the regional RSM explained how she had arranged for the END's functionality to be extended. That is, forms for some types of site activity that could not be captured in the exist-

ing END system were created by repurposing existing features of the software. For example the RSM identified the lack of a 'shift handover management report' feature in the existing system. To this end she took the structure of the existing resident record, and adapted it using existing database fields – i.e. with no need to modify the vendor's supplied database schema. This enabled staff in each unit to record salient management information (e.g. maintenance information, resident transfer data) at the end of each shift such that it was available inside the END.

This strategic behaviour of consolidating a wider range of data than originally intended by the software vendor suggests that thinking about the implementation of the END in a flexible manner can make workflow more streamlined. The RSM's interest in repurposing existing functionality also led to an interest in involvement with the software vendor forums, and an interest in persuading the vendor to implement new features in the END.

However, as well as the RSM's clear vision for the required functionality of the END, there was another very important factor that drove its adoption. That is during an accreditation exercise immediately prior to implementation, the home initially failed in the information systems component of the accreditation standard which was overturned on appeal (see section 5.3.1). The near-failure indicates that there was an immediate need for change with respect to the home's documentation system. The introduction of the END, along with the RSM's enthusiasm for computer technology provided an opportunity to fix the home's information systems. This was also well aligned to the site manager's professional interests. Thus at the regional site as well

as committed site management with high levels of computer literacy, there was an immediate acute need for change.

By comparison, at the rural site, this conception of the need for change was not as strong. While the END improvements to the resident funding process were obvious and positive from the perspective of the DRSM, at the rural site, the previous paper-based system was functioning very well. In fact it was described by a Registered Nurse (RN) at the site as one of the, if not the best paper based documentation system that he had seen of the many homes he had worked in. The high quality paper records may have meant that the conception of the need for change was not seen as urgent in the way it was at the regional site. Site managers' leadership of the introduction of the END reflected this.

For example, it may be that the training phase of the introduction of the END being concurrent with site accreditation might have been caused by management's perception of the size of the job at hand. That is, because the existing paper-based system was functioning well, there was no perceived need to change the documentation system. It is possible that the rural site's management made the assumption that the move from paper to computer-based records was a simple matter of altering work processes, and that otherwise the change would happen as a matter of course.

The management issues experienced by the rural site's implementation of the END were as follows: Firstly, the site management did not have the same level of interest and expertise in IT as that of the RSM at the regional site. As a result of this, the realisation that parts of the system could be re-purposed to provide missing fea-

tures was not realised. Secondly the site managers did not seem to act on the major distraction of accreditation during the training phase. Potential causes for this were a lack of perceived need for change, and a lack of experience with implementing IT systems. The imposition of the END by the executive management without a locally perceived need for change could be the root cause for this problem – as there was no perceived need, there was no need for action. Thirdly the combination of the lack of site management expertise with IT implementation, and the long distance from head office compared to the regional site meant that ad-hoc IT support for the END was much less convenient than at the regional site. Face-to-face support from head office required significant advance planning.

In the subsequent sections of this chapter, the results from the interviews with all users of the END at the three sites are discussed, with the aim to further explain the trajectory of the implementation of the END at each site.

6.3 Understanding positive and negative views of the system

To understand the experiences of staff at each RACH the interview guide contained questions asking about both positive and negative perceptions of the system. Positive experience was evaluated by asking staff about the benefits of the system, and what, if any aspects of the system they were happy with. Negative experience was evaluated by asking about concerns, weaknesses and frustrations with the system.

Because the rural and regional sites had pre-implementation data collection points, much of the information gathered at this point was about anticipated positive and negative aspects of the END. The rural supplementary data collection was from 12 months post-implementation onwards, so data about anticipated experience was not collected at this site. The remainder of this chapter explores these aspects of experience with the system starting with positive views, and then negative views. The final part of the chapter provides a comparison of these aspects between the study sites.

6.4 Analysis of themes: Positive Experience

6.4.1 Benefits

At the regional site, pre-implementation, managers anticipated improvements to tracking of information and management reports. This indicated an awareness of the future benefits of improving the flow of information through the RACH. Additionally, some PCWs, particularly those who were site trainers anticipated career benefits from learning new skills.

At 6 months and 12 months post-implementation, attitudes to the electronic system were generally positive. Perceived improvements to information flow through the site were confirmed. Improved search and reliability of information stored in the END were frequently noted under this category. At 12 months, one registered nurse made the suggestion that the electronic system had the potential to promote more complete information and better staff knowledge about residents if the software could provide

appropriate cues during data entry. She suggested that this had the potential to help improve staff capability, both for producing high quality documentation and the provision of care. Although it was not clear that this potential benefit was observed, its recognition demonstrates a change in the thinking of what services the END provides compared to paper documentation.

At the rural site, at pre-implementation, anticipated benefits were much less salient. The decrease in manual handling of documentation and better legibility were both noted. However, most staff seemed to emphasise the mechanics of documentation rather than its ultimate purpose of providing information to support the care of residents. That is, talking more about how data was recorded, and relatively little about what it was being recorded for. Although managers noted organisational benefits of electronic documentation (e.g. funding support) there was a more general lack of recognition of the improved information flows observed at the regional site. This was particularly apparent at 6 months post-implementation when the range of stated benefits at the rural site was much more limited compared to the regional site. The continued emphasis on the procedural benefits of the system rather than the informational aspects, suggests that at the rural site, staff were rather unsure of how the system could support their daily work.

Further evidence for this is that at 6 and 12 months, of the 28 mentions of benefits identified, 5 of these responses were that the electronic system provided no benefits or where there were equivocal mentions of small benefits. By contrast at the regional site, there were no mentions that the system had no, or only very small benefits. Mentions

of benefits could either be spontaneous during another part of the interview, or a direct response to a question (i.e. what are the benefits of the END?). A mention that there were no benefits would always be to the direct question. However mentions of benefits of the system could come up at any time during the interviews, so the data gathered surrounding benefits of the system was a rich data set, not constrained to the answer to any particular question.

At six months, one highly computer literate RN from the rural site indicated that in principle an electronic documentation system had the potential provide benefits. However, this nurse identified that the conservative design of the existing software was a problem. This was because, it modelled a paper file rather than taking full advantage of the capabilities of a relational database to view the data in a more flexible way. This RN thought that this problem may represent a missed opportunity. These kinds of cautionary comments were absent from responses by the highly computer literate interviewees at the regional site.

At 12 months at the rural site, results suggest that the benefits of improved information flow were beginning to be observed by managers. In one case, this was in an equivocal way, citing the progress notes feature as of benefit, but complaining of an otherwise cumbersome system. The nurses and personal care workers were still very much focused on the mechanics of documenting rather than on information based tasks.

At 24 months post-implementation the DRSM at the rural supplementary site anticipated large benefits from the introduction of a medication management system

with direct links to the END (in technical terms by linking databases). Although this was in the late planning stage at 24 month post-implementation, during a follow up meeting with the management group some nine months later the medication management module seemed no closer to implementation. This is discussed in more detail in chapter 7.

6.4.1.1 Most salient benefits – "What are you happiest with about the system?"

Given the clear differences between the regional and rural site, in terms of benefits observed, it follows that there should also be a difference in the most salient (favourite or most obvious) benefits. At the regional site, at pre-implementation, the things that interviewees reported as being happiest with were dominated by the improved accessibility to information, and improvements to information flow. These were mentioned as improved organisation of the documentation, better management information (including monitoring of staff compliance), improved clinical information and better accreditation and assessment information. As well as being mentioned at pre-implementation, all of these items were mentioned as features that people were happiest with at 6 months.

At 12 months, staff at the regional site were still overwhelmingly happy with the electronic documentation system. The things they were happiest about had changed to more routine issues such as the reduction in physical labour associated with filing. The availability of all resident notes at all workstations was also seen as a major benefit

by staff at all levels. The impression left was that the electronic system and its benefits had become embedded into the day-to-day operation of the site with great enthusiasm.

At the rural site, at pre-implementation, the professional nurses we spoke to could not nominate anything they anticipated being happiest with post-implementation. Managers mentioned improvements to management tools, especially the process of funding. Personal care workers mentioned better information quality produced in a more streamlined manner, resulting in saved time. At 6 months one manager was equivocal about this, while the other mentioned that although they were happy with the streamlining of progress notes, they were somewhat unhappy about much of the rest of the system. At 12 months many staff were happiest with the simpler data entry and retrieval. One registered nurse was happiest with the 'user friendliness' of the system. However there was some unhappiness at 12 months, with one RN indicating that she was unhappy with the electronic system, and one personal carer unable to name anything that she was happiest with.

At the rural supplementary site, due to the reduced number of people required to use the system and the green field implementation, there were fewer comments on what people were happiest with about the END. There were five comments related to this. Three specifically noted the quick and easy access to information. Two were general comments about being happy with the system. Rather than being predominantly about the mechanics of the documentation system (c.f. rural site), most comments were about the informational aspects of the END, for example being able to easily monitor changes in residents' care needs. This pattern of responses at the three sites

supports the idea that the collective way that the documentation system was perceived was different between the three sites. At the regional and rural supplementary sites, there was a consolidated focus on information flow and usage, while this view of the system as a whole was relatively absent from the rural site.

6.5 Analysis of themes: Negative Experience

As with positive aspects of experience with the system, negative aspects can be divided into anticipated (potential) concerns, and realised (experienced) concerns. As with benefits, negative findings are not directly comparable for the rural supplementary site, as for the other two sites. This is due to it being a green field site, and due to the lack of a pre-implementation data collection stage.

6.5.1 Anticipated concerns

Anticipated but not realised concerns at the regional site were: whether training needs were met, whether the system would result in double entry of information and whether the system would cause risk of data loss due to problem with the user-interface. At 12 months post-implementation, one manager was concerned with the possible unresponsiveness of the software vendor when requesting feature enhancements. Given the long anticipated, but slow to introduce medication management system, and other problems described below, this seems an anticipated concern that was probably realised.

Still at the regional site, the organisation's ability to maintain training over time

were mentioned as concerns, but at this site, that concern did not seem realised as it was only mentioned at early interviews. Staff literacy levels (e.g. spelling, grammar) were mentioned as a potential concern pre-implementation, but were not mentioned subsequently.

6.5.1.1 Bowel charts

The main realised concern at the regional site was the bowel chart data entry. This caused problems, as it was only possible to enter data for one resident at a time, resulting in a large number of clicks to enter each resident's data onto the computer. This meant that the task could take up to 45 minutes of a shift, at least in the low care environment where the caseload is high. In comparison the old paper-based tick sheet system might only take up to five minutes to complete. The large increase in time commitment may not be an exclusively negative outcome. Requiring PCWs to engage in frequent repeated use of the system seemed to enable them to understand the role of the documentation as an information resource, as this regular usage habituated users to the system and built familiarity. At the regional site there was greater awareness than other sites, from a wider range of staff that the END could contribute to improvements in job knowledge as well as routine documentation, perhaps arising from more pervasive use of the system at the site, via use of the END in performance appraisals, and resource planning.

At the rural site, the electronic bowel charts were discarded after a very short trial. Data recording for the bowel charts returned to paper, meaning that high care PCWs

were only supposed to use the system for exception reporting, or for assessments and exception reporting in low care. It should be borne in mind that there were far more PCWs employed in high care than low care. In fact high care PCWs were the majority of the care staff at all of the study sites, thus limiting their use of the system is likely to limit opportunities for knowledge transfer in the END system. The electronic bowel charts were never used at the rural supplementary site. This was due to the different implementation strategy used here than at the other two sites, where high care PCWs were deliberately kept away from the system in order to simplify the initial implementation task. Although limiting the number of users seemed to work well at the rural supplementary site, as a part of the planned implementation strategy, it did not work as well at the rural site where lack of usage was caused by lack of training, and resistance.

6.5.1.2 Speed of workstations

When discussing the speed of the system, it is necessary to describe the computing infrastructure in some detail. Following this the infrastructure is then related to the comments of the interviewees about the speed of the system.

The thin client workstation infrastructure backed by centralised storage at a Sydney data centre was detailed in chapter 5. My consultations with network professionals familiar with the network topology of the regional internet infrastructure indicated that there was unlikely to be any significant difference between network speeds at each site. Having said this, late afternoon network congestion may have been more likely at the

two rural sites than at the the regional site. Given that the busiest documentation times were around the two hours after mid-day, this suggests that network slowdowns would not be a big factor. A more important network issue was observed by night shift staff who observed the system becoming unusably slow in the small hours of the morning due to the nightly system backups.

As speed was a common concern, I also discussed the bandwidth requirements for the thin client architecture with my network colleagues. At all sites, the number of workstations likely in use at any one time and the available bandwidth (dual ADSL2 links) suggested that the available bandwidth to these two sites was around the minimum to make the thin client network viable. At the rural supplementary site during the study period there were somewhat fewer workstations, and they were less heavily used, and thus the network had more spare capacity than at the main study sites.

Additional to this, each site had identical problems with network configuration early after implementation. RNs and other more senior staff would use the system through Citrix (special thin client software). These individuals had the END system running at acceptable speed. For around the first six months post-implementation, PCWs who did not have access to Citrix found the system unacceptably slow. The root cause of this was found to be a network configuration issue, and was fixed at six months post-implementation. I observed this during the six month visit at the regional site, and it occurred shortly before the six month visit at the rural site. The rural supplementary site was not affected by this as up until around the 18 month visit, the only users were RNs who had access to the Citrix system. Thus the problem

did not manifest at the rural supplementary site despite having the same underlying architecture.

An interesting feature of this configuration problem was that at the two main sites, PCWs with high documentation loads (mainly low care PCWs but some in high care) were given temporary access to the Citrix system. Some affected staff saw this as conferring status, and were reluctant to give up this privileged access after the network problem was fixed. Possibly related to this issue, at the twelve month stage at the regional site, some PCWs seemed to feel excluded from communication in the home which was increasingly occurring via the email system. That email access seemed to be provided, then later withdrawn, leading to some minor dissatisfaction among some affected staff, and reflected the importance of electronic communication at this site. Email, and the computers more generally were not used as communication tools to the same extent at the rural site, and thus the issues with exclusion as noted above did not arise as they did at the regional site. This can be viewed is a divergent political outcome, in part driven by the different uses of electronic communication at each site.

Initially after examining the coded data on workstation accessibility and speed, I found that the mentions of the system being slow were very similar between the two main study sites at all stages of implementation (see table 6.1). The impression was that the poor speed of the system was perceived as a much more serious problem at the rural site than the regional site. However, the speed of the system was not a serious concern at the rural supplementary site.

Table 6.1: Frequency of usage of the word "slow" at each study site

Site	First visit*	Second visit*	Third visit*
Regional	1	8	3
Rural	0**	10	4
Rural-sup	1	1	0

* Pre-implementation/six months/12 months for main study sites. 12, 18 and 30 months post-implementation at the rural supplementary site
** One mention of a concern about workstation availability

To explore in more detail aspects of the speed of the END, I searched for the word "slow" among the interview transcripts at each site after cross-referencing and searching for synonyms as found in the Wordnet lexicographic database (Miller, 1998). The results of this analysis is shown in table 6.2, and supports that the speed of the computer system was perceived to be a bigger problem at the rural site than at the regional site.

At pre-implementation, anticipation of problems with the speed of the computers was mentioned ten times at the regional site, compared to five times at the rural site – that is 50% more frequently. This indicates a possible greater awareness of the speed of the computers at the regional site. However at six months post-implementation the number of mentions of slowness as related to the END was slightly higher at the rural site. At 12 months there were around double the number of mentions of slowness at the rural site than at the regional site. The content of the comments about slowness at the regional site generally indicated that the speed related issues were perceived as less severe than at the rural site.

Table 6.2: Analysis of context of usage of the word "slow" at each study site

Regional	
Pre-implementation	
Slower than other staff to use the computer	1
Slow typist	1
Will be initially slow to use the system	2
Sometimes the computers will be slow for an entire day	6
Six months	
Speed of system has improved	2
Speed of system is a problem	9
Slow workf ow due to waiting for workstations	1
Was slow to learn the system	1
Was a slow typist	1
Intermittent slow computers	1
Slow system workf ows (e.g. 17 clicks to complete a simple task)	3
Slow in the afternoon (upstream network congestion?)	1
Slow external systems (e.g. MIMS online)	1
12 months	
Occasional slowness	1
Frequently slow system	2
Speed is much improved	1
Slow to login	1
Slow workf ow	1

Rural	
Pre-implementation	
Slow rollout/training process	3
Slow typists	1
Pressure to be as slow as others if computer literate	1
Six months	
Slow computers	25
Intermittently slow computers at specif c times of day	1
Slow work f ows	4
Slow typing skills	1
Slow rollout (and big shoes to f ll with the previous paper system)	1
Speed of system has improved	2
Twelve months	
Computer are still slow	5
Slow workf ow	3
System is slowly improving	1
Slow external systems	1

Rural suplementary	
Twelve months	
Slow due to poor computer skills	3
Slow development of system capability	1
18 months	
Intermittently slow workstations	2
System is a little slower than previously	1
30 months	**0**

6.5.1.3 Other concerns

When asked about the safety of the END system staff universally expressed confidence in data integrity and back up procedures. Some concerns about double handling of resident data (dual data entry) were expressed at both the regional and rural site by managers. This was due to lack of full integration between the progress notes, charting features and care plans. At the regional site this was only reported at pre-implementation stage at six months after implementation. At the rural site, this problem was reported at six months and at 12 months. As well as this, at the rural site there were greater concerns about the workflow in the software, and the ability of staff to record appropriate data about residents.

The rural site concerns seemed in large part due to the sizable secure (dementia) unit at the rural site, which was managed by a LCTL with a strong interest in dementia care. It appeared that the END system was designed to closely model the Aged Care Funding Instrument (ACFI) assessment system. Much of the behavioural care and family liaison required in dementia care is invisible work (see section 7.11 for more context) as the types of care activities required were not well covered by the ACFI. Because of this, the LCTL perceived a mismatch between the documentation needs of her residents, and the provision for the systematic recording of behaviour of residents in the END. The LCTL felt that the care planning features did not fully meet her unit's needs. To fix this perceived problem, the LCTL developed a parallel paper based system in order to record the types of behavioural information that she felt necessary to support care in her unit. This paper-based behavioural monitoring

chart was clearly of high quality as it had been well received when presented to her peers at conferences.

A further issue that was observed by one low care PCW at the rural site was that she did not feel confident in the local security of resident information. This was due to the site being in relatively small town, and the fact that all residents information was available to all staff at the site. Thus this person felt that there was a local risk regarding resident privacy. However this was only mentioned by one staff member, so the potential problem although experienced by some, was not widely expressed. Upon entry to the RACH, each resident had signed consent for personal information to be shared with services and providers at the discretion of the home. It is the policy of the organisation to give care staff access for every resident in need of care at the site. Therefore this particular concern is about a possible unintended consequence of the improved accessibility of the nursing documentation.

6.6 Discussion

This chapter covered the experiences of the staff affected by the END. In particular the discussion of benefits and problems with the END mentioned during the interviews was examined. The initial part of the chapter discussed the management perspective of problems and benefits. What emerged from this was that aspects of the leadership of the implementation of the END at each site were important for setting the trajectory of the implementation. Following the discussion of managers' attitudes to the END, the

floor staff's attitude to the implementation was examined. The relationship between management's perception and that of the floor staff was informative in understanding the process of change. The contrast between the END implementation at two brown-field sites, and one green-field site also informed perceptions of the success of the END.

The DRSM at the rural supplementary (green-field) site exerted maximum managerial control over the END implementation. This created clearly defined roles of users of the END (professional nurses, allied health workers, gradually low care PCWs), as well as non-users (high care PCWs). A clearly defined responsibility for documentation closely reflects my experience in hospitals as both a nursing assistant and as a research psychologist in the 1990s. In these settings, care assistants and orderlies were closely supervised and were not required to document anything other than incident reports. As such this approach appeared consistent with the approach I observed when working in clinical healthcare. Although in the RACH it seemed to make for a quick and simple initial implementation, the management group observed a problem with this approach. The problem was that a lack of direct responsibility for documentation could result in perceived or actual second-hand reporting (i.e. the RN documenting based on verbal reports rather than direct observation). It is possible that the use of this distribution of responsibility for documentation could be unacceptable given that documentation accreditation requires identification of care needs and responding to those needs in a timely manner. As PCWs are the care staff who directly responsible for the daily activity of residents. If they were not required to

report the care needs or the change of care needs for a resident, it is highly likely the care needs would be slipped without notice, thus leading to needs not being met. Thus it is possible that this approach is does not comply with the accreditation standards, so excluding high care PCWs from the documentation process might introduce risk to care services. This certainly seemed to be the view of the management group after data collection had ended. In particular, based on information provided by the staff at the head office, there was a perceived need for ongoing training at the rural and rural supplementary sites, as insufficient numbers of staff were trained on at the end of data collection.

Making certain staff solely responsible for electronic documentation at the rural supplementary site was an efficient strategy to meet the immediate needs of implementing a functioning END system. However it required more ongoing effort to meet staff training needs. It is important to note that for those who used the system at the rural supplementary site, benefits were clearly observed, and drawbacks of the system were rarely observed. this indicates that the END had integrated into the site's operation very efficiently.

The regional site's implementation was also successful. This site's ongoing issues with the slowness of the computers seemed to be related to the fact that there were more people using the system rather than any differences in IT infrastructure. Although with similar range of concerns with the system as at the rural site, there was a greater range of perceived benefits among all staff. Rather than the constrained, selective implementation at the rural supplementary site, the leaders at the regional

site displayed a strong desire for inclusive end-to-end integration of the END. This meant that almost all staff were required to use the system, and the inclusive approach to usage was enabled by the successful training strategy and practice.

A small number of staff were able to speak about the potential of the END as a tool to enhance work knowledge. For example the computer made ensuring that assessments had been completed properly, and allowed faster and more efficient review of changes to residents. This suggests that a comprehensive approach to implementation potentially had wider-ranging benefits beyond a more streamlined use of information within the RACH. However it was also clear that much of this potential had not yet been realised. This was possibly due to user interface limitations (see section 6.5.1, section 6.5.1.3, section 7.5 and section 7.8) with the software, and management's lack of awareness of the creation of new resources (i.e. a body of staff who were developing skills for training others). Unfortunately the root causes of these unrealised benefits, not using new staff's skills, and being unable to use the potential for aggregate data entry are difficult to resolve in the present economic and political climate. The conservative design of the software seems to reflect the conservative nature of aged care, and thus the vendor may have been reluctant to provide innovative user interface features. The lack of recognition of staff's new capabilities from management was probably caused by the onerous resource constraints under which RACHs operate. These constraints may have had an effect on the ability to recognise and/or encourage changes to work systems that enhance and recognise new capabilities of staff.

This lack of recognition of the potential for staff development may have been as

a result of the relatively small size of the management group. For example another management group I visited as part of the questionnaire data collection activities for a different research project, was large enough to employ dedicated clinical nurse educators. Some of these teaching staff recognised that learning the END system created new opportunities. However there was no evidence for this type of formal career development activity at the study sites regardless of the success of the implementation.

Finally the rural site's experience of the implementation seems to have been less successful than the other two sites. Because of the very high quality of the existing paper-based system, there was a much lower conception of the need for change at the rural site compared to the others. This may have caused the initial process of implementation to have been less well thought out. By contrast, this conception was strong at the other two sites – where the paper-based system had been recently assessed as being close to a failure, and an entirely new documentation system was being introduced respectively. Thus the staff were less aware of the information flow implications of the system at the rural site compared to other sites – there seemed to be a much more *laissez faire* approach to ensuring full adoption of the system than the other sites.

It must also be noted that the regional RSM and the rural supplementary DRSM had strong interests in computers. A similar 'IT champion' was not identified at the rural site. The main problems at the rural site seemed to be that training and accreditation had been allowed to clash.

The lack of requirement for frequent repeated use of the system by all staff (com-

pared to the regional site) may explain a more general reduced engagement with the system. This in turn could lead to a reduced awareness of the END's capabilities, and staff being less used to the systems limitations.

However, this does not explain why some of the expressed documentation needs in the the rural low care were not seen to be met by the END (e.g. in the secure unit). This seemed to be more due to a conflict between the specialist expertise in management in the low care unit, and the lack of emphasis on behavioural issues in the END system (see section 7.4.2). Many RNs suggested that the END was largely designed as an administrative, rather than as a clinical tool, where administrative requirements could conflict with clinical requirements. For example, with residents' behavioural management, reconciling the need for good clinical recording with the design of the END as an administrative tool seems a significant challenge. This is discussed in more detail in section 7.6.

Awareness of the system's capabilities, and the strategic thinking in evidence from the leadership at the regional site did not seem to be present at the rural site. Thus the potential to re-purpose existing features of the system (for example the way the regional RSM used a modified patient record as a basic shift handover report for management) was not recognised. Therefore this was not investigated as a way of meeting some of the low care unit's identified documentation needs. The relative lack of conception of the need for change, and the lack of local IT expertise, seem to be good reasons why the ability to make minor local modifications to the system was not realised at the rural site.

6.7 Conclusion

Analysis of the interviews strongly suggested that the attitude of the site managers to the implementation of the system had a strong effect on the outcome of the implementation of the END. While the regional and rural supplementary sites' implementation were very successful with staff looking forward to the future of the END system, at the rural site this was not so evident. The reasons for this seemed to be closely related to the site leadership and the conception of the need for change. Given the reduced perceived urgency of the need for change at the rural site, it may be that the significance of the training process was not fully recognised. Thus the generation of a critical mass of site trainers was not achieved. This meant that awareness of the capability of the system and how to make best use of it was not as present as at the other study sites. However, the clash of the accreditation and structured training may not exclusively be the fault of the site management, but a shared responsibility with the management group.

So while an attempt was made to perform a broad implementation as with at the regional site, awareness of affected staff did not seem to be good enough to effect this in an efficient manner. Thus top-down features (leadership and strategy) led to the relative failure of adoption by floor staff which led to a situation where the END was not adopted and accepted as well as at the other study sites

As discussed above, one clear problem for the rural site was a gap in the data stored by the END, and the data needs of the rural sites' specialist low-care dementia care. The END system's lack of features for direct recording and assessment of behaviour

centred care seems a compelling reason to assert that the system did not meet local needs. However, this could have as much to do with local awareness of the capability of the END. It also reflected weakness in the functionality of the END, which needs further enhancement to meet dementia case needs. While this conclusion emphasises the problems with the END implementation in fact, as an administrative tool for streamlining the link between clinical assessment and resident funding, the END was very successful. The different experiences at each site indicate that while this core function was met well, the leadership, strategy and development of a critical mass of care staff that knew the system well seemed to be required in order to maximise the return on investment in the system.

Chapter 7

Impacts on work practices

7.1 Introduction

Work practices encompass a range of activities. They relate to the day-to-day activity of staff in the workplace, and are part of the process of performing work. Therefore this chapter mostly covers issues related to the process of change – the way that work or attitudes to aspects of work changed over time. Work practices are not the same as work activities. Activities can be studied with time-and-motion, and work sampling approaches (e.g. Munyisia, 2012). By contrast, the concept of a work practice goes beyond immediately observable activity. The distinction between studying work activity and work practice lies in whether the content of work is investigated. For example the observational approach to studying work activities can capture that communication occurred, or that the frequency of communications changed over time. However, it will not easily capture changes to the content of communication. Similarly that

this is interview based research, communication was not generally observed directly – although interviews were often interrupted by examples of verbal communication. Work practices pertain to the activities required to do work, the protocols describing these activities (e.g. nursing protocols in the current context). These practices dictate the frequency of activities, the steps surrounding them, the way protocols are divided. Work practices also encompass culture, a large more nebulous concept. The content of this chapter summarises what interview participants said about their work practices.

As with results presented in previous chapters, the interview transcripts were coded and analysed to identify themes about work practices that emerged during the interviews. When directly asked about observed changes to work practices, participants often gave vague answers. However due to the conversational nature of the interviews work-practice related issues emerged at other points during the interviews – for example when discussing the assessment of residents, the impacts of the Electronic Nursing Documentation (END) system on managers, the impact on care work and the impact on external relationships. For this last category, how to handle documentation after visits from medical practitioners was the main topic. This means that much of the data for this chapter comes from the thorough understanding of the interviews content via the coding process. Follow up issues were examined by using a word search strategy to extract information about specific issues.

Changes to management practice are discussed first. This is followed by examining changes to work practices for floor staff. The three categories of floor staff practice discussed are clinical/care impacts, handover and other verbal communication, invis-

ible work, and external relationships. As with the previous chapter comparisons are made between the two main study sites, and the supplementary site.

7.2 Impacts on managers' work practices

As was explored in the previous chapter, managers' approaches to introducing the END were quite different at each of the study sites. However probably the most important change to work practice caused by the introduction of the END was universal across the sites, and had the largest impact on the Deputy Residential Services Manager (DRSM)'s work. One of the DRSM's usual duties is to collate and submit the assessments for Aged Care Funding Instrument (ACFI) packages to Medicare. Prior to the introduction of the END, this was a large paper exercise. The required workflow for this would involve:

- Collating assessments, possibly from multiple physical sources
- Determining outstanding assessments required (and were they misfiled?)
- Making photocopies of relevant assessments or copying assessment details onto separate forms
- Printing out any computerised information required
- Posting to Medicare
- Collating and re-sending material if further information is requested
- Dealing with any mistakes detected by the funding body resulting in requests for further information

- Awaiting response by funding body by post to reconcile response with Electronic Funds Transfer (EFT).

By comparison the END system simplified this workflow to the following steps:

- Collating assessments from END system
- Determining outstanding assessments required by reviewing END.
- Using reporting tool in END to create Extensible Markup Language (XML) file for consumption by Medicare web service.
- Dealing with any errors/inconsistencies.
- Sending XML to Medicare
- Awaiting electronic response from Medicare, and reconciling with EFT
- Dealing with errors/inconsistencies required and resubmiting as required.

As can be seen from the above description, the END simplified two main parts of the process – the collation of information, and the communication with the funding agency. While there is only one step less in the electronic workflow, all steps are quicker, and the work largely occurs at a computer workstation, rather than at multiple locations around the Residential Aged Care Home (RACH). Thus managers were generally happy with this. This improvement to workflow made maintaining the financial viability of the home much less onerous. Therefore it was adopted and used

with very positive reports at all three study sites. By contrast, monitoring staff documentation compliance which was another work practice enabled by the END was much less widely used.

The outcome of use of the END as a tool to monitor staff's documentation compliance (see section 5.5) was much more variable between sites. It is possible that the greater conception of the need for change at the regional site had a much larger effect on the use of the END as a performance appraisal tool than the other sites. Combined with the requirement that all staff use the END to record patient chart data (especially the bowel movement recording) meant a greater penetration of usage of the system than at other sites. Thus, usage of the END at the regional site was a more meaningful performance metric for all staff than at the other sites.

By contrast the monitoring of compliance seemed more restricted at the other sites. During the study period, there was simply less requirement for this at the rural supplementary site due to the restricted numbers of staff using the system. The DRSM did mention restricting the number of users of the software as a way of simplifying the training and performance management aspects of the END introduction. At the rural site, proactive management of compliance was not mentioned. However, reactive responses to missing assessments and other issues with management data were mentioned (see the quote from the rural Low Care Team Leader (LCTL) in section 7.9 for an example). As with other aspects of the implementation, this reinforces the idea that the rural site's implementation strategy was more ad-hoc than at the other sites.

The changes to managers' work practices clearly showed improvements in funding administration at all sites. The other changes to work practices were more heterogeneous. Broadly, the findings above are consistent with the findings in the previous chapter. That is, all sites could be seen to have had a good experience with the introduction of the END in terms of the core administrative functionality. However, the rural supplementary site's management seemed to be less proactive in terms of understanding what needed to be done to smooth the introduction of the END. It seems likely that this was because the conception of the need for change was low, training was incomplete, and there was not a computer literate "champion" for the END on site. By contrast where the conception of the need for change was high, the strategic approach to implementing the END was much more in evidence at the two other sites. At the rural supplementary site the primary strategic goal may have been to optimise workflow. That is, the DRSM had organised the implementation such that managers had maximum awareness of who was using the system, and the information contained within. By contrast, at the regional site the Residential Services Manager (RSM) had organised the implementation to maximise penetration of the usage of the END. This seemed to encourage a maximised awareness of the need for proper handling of resident information at the home. The remainder of this chapter will show evidence that the approaches at the two other sites were related to these two distinct strategies.

At six months, the regional RSM described picking up inconsistency between different parts of the END information as a result of preparation for a scheduled outage

> [The maintenance window] was on a Friday afternoon. By Friday morning I knew we wouldn't have access to [the END] so I printed handovers for the last three days for every house. And by doing that I noticed that one of the staff had recorded this person has an incident but that there was no incident report, so it allows you to pick up things that otherwise you wouldn't [...] It does give you easier access to things, and [it is] easier to know things that otherwise you wouldn't because there is no way I could go through all the files every day.

This description of a relatively unusual set of circumstances – scheduled maintenance was rare – indicates two things. Firstly that the RSM had a very optimistic, positive attitude to the END. Secondly that if aspects of the system's workflow were improved the benefits to end users would be clearer. For example the design of the handover reports are an example where the ability to make better use of the information contained within the END could be improved such that the benefits of the system were clearer to end users.

7.3 Impacts on care work

The interview questions that corresponded care impacts of the END were:

1. "What are your biggest challenges in providing quality care?" (care process)
2. "Does the electronic system have any impact on care of the residents?" (care impact)

3. "Are there any clinical consequences that arise from using the electronic documentation system" (care impact)

While discussing changes to the care of residents resulting from the implementation of the END, staff talked about the provision of direct care in two different ways. Firstly there was the process of providing care – routines and procedures that need to be followed for organising the work during a shift that pertain to the provision of care across the site which I call "care process". Secondly, changes to treatment, and the treatment programme for individual residents, which I will call "care impact". Question one is an attempt to probe care process, and questions two and three are about care impact. However the interview transcripts as a whole contained rich content on work practices and care processes.

Munyisia, Yu and Hailey (2011a, table three) collected work sampling data at the regional site. This was done at four data collection times that overlapped with my data collection. It shows that time spent by high care Personal Care Workers (PCWs) on documentation was between about 6 to 11% of their work time. The outcome was that they were spending slightly more of their work time on documentation at 12 months post-implementation than at pre-implementation, but less than at three and six months post-implementation. Time spent by Registered Nurses (RNs) ranged between about 15% and 36% with no significant difference between pre-implementation and 12-months post implementation. This pattern also applied to Enrolled Nurses (ENs) who spent somewhat more time on documentation than RNs, at between a quarter to a third of their time. This means that in terms of time spent on documenta-

tion tasks, and using documentation, the PCWs' direct interest in the documentation system was much lower than the RNs and ENs, because they spent so much less time on it. Instead their work is directed by the RNs and ENs who used documentation and patient interactions to determine what care work needed to be done.

The work patterns at the other two study sites would have been quite different, not least because they did not use the electronic bowel charts. In the case of the rural supplementary site the high care PCWs did not use the documentation system at all. We also had no data on the changes to time spent on documentation in the regional low care home. However this was a useful indication of the degree of concern each staff member was likely to have about the END. It seemed reasonable to infer that a low care PCW would spend more time on documentation than a high care PCW, and less than or equal to the time spent by RNs or ENs.

The data on how much time each type of care staff member spent on documentation provided information on how important documentation was to each staff member's working life. Having established this, the impacts of the END on different documentation activities are now examined.

7.4 Assessments and Care Planning

Assessments and care planning are closely linked. The assessments are used for identification and recording a resident's care needs, for providing person-centred care, and for obtaining government funding. Invisible work, not accounted for by the funding

instrument is also discussed later in this chapter. Together, progress notes and assessments contained the written information based on which a care plan was composed. Other sources of information for care planning are verbal communication and direct observation of resident during provision of direct care.

The primary purpose of clinical assessments are to ensure that optimum care is being provided for each resident. In turn these assessments ensure that the resident receives enough funding from the Federal Government to provide appropriate care. Resident attributes that are assessed for funding include pain, personal hygiene, physical status, exercise, sleep, complex nursing, verbal behaviours and wandering. Electronic assessments took about four months to be introduced into each home as part of the staged implementation process (see section 5.4).

7.4.1 Regional Site

At the regional site, pre-implementation, staff involved in the administrative aspects of work anticipated that the practice of completing and maintaining the schedule of resident assessments would be improved by the use of the END. This included essentially all staff except high care PCWs. The RSM, while encouraged by the lack of doubling up of assessment activities was concerned with a relative lack of flexibility for the way assessments were presented in the END. In particular, the schedule of assessments was only available for one individual resident at a time. Aggregated reports of outstanding or upcoming due assessments for the home, or area within the home was not available from within the END software. This meant that the workflow

of checking each resident's assessment status was more labour intensive than it could have been.

At six months post-implementation, the electronic assessments had been successfully introduced into the high care unit and were used by the RNs and ENs. In the low care unit electronic assessments were used somewhat less successfully. Here the LCTL reported that they needed to spend a significant amount of time following up on documentation compliance. Some staff observed limitations with the user interface for care plans. The most commonly reported problem related to the care plans were very long multi-screen forms (i.e with an extensive vertical scroll area). When a field was updated, the page would jump back to the top of the screen which would result in the nurse entering data losing her place. The other problem reported was the same as for assessments – a lack of nuance (see the next section on the Rural site).

For the RNs, the computerisation of the assessments created a problem under a specific set of circumstances. At the regional site, most care staff periodically rotated onto night shifts. That is, they worked a combination of morning, afternoon and night shifts over a monthly cycle. At the other sites, staff tended to be day staff, and favoured either morning or afternoon shifts, and there were separate night staff. For RNs this created differences in work habits than those at sites with specialist night staff because of differences in the way work was allocated. At the regional site, the RNs were in the habit of using their night shifts to catch up on their documentation backlog, especially related to assessments and care planning. RNs at the other sites who did not regularly rotate onto night shifts were unlikely to have this relatively quiet

time. The consequence of this is more frequent 'working back' after the end of the shift in order to deal with backlogs. Note that a certain amount of working back is normal and expected for RNs, but is unusual among high and low care PCWs. Unfortunately, with the night shift being used for scheduled back ups, the END was unusably slow for a significant part of the shift. Thus to some degree the END disrupted some work, and reduced the amount of time available for RNs who did rotating shifts to catch up on documentation.

In general at the regional site, the assessment forms in the END were well regarded. The electronic assessments, along with use of the email system to follow up missing data and the employment of a full time ACFI coordinator (a former Acting LCTL who was an Enrolled Nurse) meant that the END was regarded as providing high quality information resources.

7.4.2 Rural site

As with previous findings, staff at the rural site's attitudes to the assessments within the END were more critical, and the system was thought to be less beneficial. This was despite staff looking forward to the introduction of assessments at pre-implementation. At six months, several RNs and managers mentioned that the assessments were very 'generic' and repetitive. This generic nature of items is different from the lack of flexibility of data display mentioned by the regional RSM.

By 'generic', interviewees meant that a given assessment did not capture important information about a resident's condition. While it was possible to make progress notes

about care requirements, when dealing with care plans, doing so in the END involved a cumbersome workflow, as clicking through many screens was required. One low care PCW described the situation as: "it just asks set questions and you can't sort of vary from them". My interpretation of this is that some staff felt that the assessments were too mechanical, and did not sufficiently cover qualitative nursing judgement. One RN directly linked this to the change from the old Resident Classification Scheme (RCS) funding mechanism (see section 5.1.4) to the assessment based ACFI system. There was a general consensus that the ACFI had made the funding process much more streamlined and fairer, with less gratuitous documentation (i.e. progress notes) that contained little or no information (e.g. "no change"). However, the side effect of this was that when documenting in the END, the facility to record observations was limited.

Related to the mechanics of the END, there was a clickable link between care plans and assessments available through the user interface. However, there was a lack of a direct link back to progress notes from the care plan. This meant that assessing and documenting non-fundable care in the END was not straightforward. At six months, the rural LCTL said "we are having trouble with care plans at the moment they are not really performing how we want", and at 12 months she was concerned with the long-winded, low information density care plans. Also by 12 months the idea that the assessments needed the capability to record information about "grey areas" – qualitative observations – was widespread among RNs, ENs and high care PCWs. Again this pointed to a perceived lack of flexibility of what should be recorded as a

part of assessments.

As opposed to the mixed rotating shift environment at the regional site, the rural site operated what was mostly a fixed-shift system with staff specialising in a particular time of day. Therefore a morning shift RN had a much heavier documentation load for a smaller number of residents, and would frequently have the support of an EN for medication. An afternoon/evening shift RN had a much lower documentation load than the morning shift staff, but had less support from other professional nurses. As a result they spent more time on direct care, especially once the nurse managers had left after 5pm. At this point the remaining RNs on site then became responsible for some duties in the low and secure care unit. The night shift RN, of which there was only one present, was responsible for the whole site. Therefore night staff had some documentation duties, for example, auditing assessments for completeness, and completion of sleep assessments. However, there was not the opportunity to catch up on work during the relatively long quiet periods during night shift as there was at the rural site.

The rural LCTL made a link between the documentation system's lack of accounting for some kinds of invisible work (see section 7.11), particularly with respect to documenting behaviour issues, especially in the secure dementia care environment. Secure care is an area where behavioural disturbances and cognitive decline are the primary problems of residents, thus tracking progress and anticipating treatment through detailed behavioural recording can be valuable. Examples of the benefits of comprehensive reporting on behaviour are improving staff orientation to resident problems,

and improved continuity of care (Robinson & Cubit, 2007, p. 261).

7.5 Rural Supplementary Site

When physiotherapist notes were integrated with the system at 12 months post-implementation there was a problem with incorrect undeletable duplicate physiotherapy assessments appearing in some residents records due to data entry error. This example shows that the END implementation was problem free at this site. However the site seemed to be well equipped to deal with issues related to the END as they were encountered. The high levels of managerial control, and a fixed shift system meant that for the most part, only morning shift RNs were intensive users of the system, unless others were given a specific task by the DRSM (e.g. regular bi-monthly reviews of care plans during night shift). See section 6.2 for an extended quote on the DRSM's rationale for the controlled implementation.

As noted previously, at this site, fewer staff used the system than at the other sites. At 12 months post-implementation, low care PCWs started using progress notes. According to the DRSM the already extensive use by RNs meant that the low care PCWs became comfortable with using progress notes very quickly and only limited management oversight was required to ensure compliance. The DRSM noted that the advantage of this method of implementation of the END meant that by the second cohort of users, the first cohort had become comfortable with the system by persistent repeated usage: "so the more confident you are, the faster the process

becomes".

At this site there were two laptops which were often used for bedside assessment recording at the 18 month and 30 month visits. This usage was absent at the other two study sites. Although the other sites did have laptops for mobile usage, the nursing staff there regarded them as impractical due to workstation availability – they would sit in the nurses' office where they were most needed. The laptops were also used by RNs in attendance at medical consultations (more on this in section 7.12). As at the rural site, the DRSM was responsible for ACFI assessments. She noted some weaknesses with the user interface similar to that noted earlier among RNs (where screens did not maintain scrolling position). The same lack of integration of medication information into the funding application process that the rural DRSM observed was also observed at this site. Unlike the rural site, this led to the DRSM indicating that they looked forward to the long awaited medication management features to be added to the software (see section 7.6).

Talking to the RNs, and a part time PCW who also performed an administrative support role it was clear that their usage of the system was fluent. That the END system at this site was functioning very well as evidenced by the staff and the managers having clearly defined roles in the way that they interacted with the END. There was little or no ambiguity with each staff's relationship and usage requirement for the END system. This was at the expense that many PCWs had no requirement to use the system which as noted previously which was perceived as posing certain regulatory risk by the management group. The way that the END was used with medical visits

(detailed in section 7.12) also suggested a well integrated 'low friction' (my term) documentation system. At 30 months, the long complex, hard to navigate care plan document was noted at this site by the LCTL (also mentioned at the rural site). This was especially with respect to a lack of aggregate reporting suitable for the nursing staff to use to support care. At this site, the DRSM noted that the END had the capability to "reinforce nursing judgement, due to the availability of evidence based assessments. However the outcome [e.g. care quality] is still up to the nurse.". For the provision of direct care, the lack of flexibility with assessments referred to previously was noted by some RNs as an issue.

7.6 Administrative versus care impacts

As a tool to support administration and funding the END was received with great enthusiasm and was seen to be a useful tool that saved time and improved accuracy of records. The one identified missing feature with cumbersome workflow was a lack of integration of the medication information required for funding with the rest of the END. The rural DRSM described the problem quite clearly:

> What I have to do is [photocopy, scan, then] e-mail [the medication sheets] to myself and then uploaded into a file in one of my drives and then put that into [the END]. So that is really time-consuming. I've got to photocopy it then e-mail it to myself and then file it up.

As noted, while a medication system was planned, talking to managers indicated that the timetable for medication integration was optimistic. At the time of writing (over 18 months since the final data collection), the medication management software had still not been introduced to the site. However, as the perspective of the management group is long term, and the introduction of medication management software will aim to last for the lifespan of the homes, this slow implementation approach is appropriate.

7.7 Aggregate reporting

As noted in section 6.5.1.1, the lack of aggregate data entry facilities (e.g. bulk assessments such as the bowel charting and activities of daily living) was a problem for floor staff (RNs and PCWs). However some aggregate data retrieval was possible although this seemed to be exclusively used for managerial purposes. Examples of this were the monitoring of system usage at the regional site, and for clinical indicators used in resource planning. The care related use of documentation was generally centred around care plans and individual assessments.

7.8 Does the END provide knowledge support for the provision of direct care?

The views about the documentation as a knowledge resource to support care were mixed. The two most extreme perspectives on this were informative. The negative perspective was that care staff got to know the residents by providing care to them over time, and that the documentation was not directly useful in understanding care needs. This view was more prevalent among PCWs at all sites, and RNs at the rural site. This was also implicitly the case for non-END users at the rural supplementary site. Non-users at the rural supplementary site had very limited exposure to the END. Thus they could not use it directly to acquire resident information. One rural RN thought that documentation was of limited relevance to care: "If you've worked long enough, you know the resident, then you can observe that there's something amiss, you can read all [the documentation] you want [but it won't make any difference]". Conversely, more senior staff did see strong benefits for the use of the END as a support tool for the *planning* of care, due largely to the lack of manual filing. Because the information was available from any workstation, this meant that fewer interruptions were experienced when gathering information.

The discussion of the relationship between the END and its role in supporting care above shows that the relationship between the electronic documentation system and the provision of care is quite different for the various roles in the organisation. The range of effects mirrored the hierarchy of the organisation from little or no impact

for most high care PCWs, to a substantial positive impact for site managers. At the mid-point (i.e. professional nurses) it seemed clear that while some staff made a lot of use of the END as a tool for improving care, many also did not. It may be that this variability was partly due to differences between the computer knowledge of the staff, as well as the more cumbersome aspects of the user interface.

7.9 Does the END support care quality and care outcomes?

The two main issues at all sites that affected quality of care were time constraints and staffing issues. The third issue was poor quality information resources, mentioned at pre-implementation by a manager at the regional site, and mentioned at 6 months post-implementation by a manager at the rural site.

At both the regional and rural sites, meeting and understanding the care needs of residents were highlighted as significant contributors to quality of care issues. Some staff thought that it was possible that the END could help with these issues at all sites, but the perception was that this was only realised at the regional and rural supplementary sites. At the rural site, it was clear that at least one manager felt that information resources were poorer than when the documentation system was paper based – "things aren't followed through ... [symptoms] get lost in the system, people don't follow that through and it becomes a crisis, medically". This opinion was validated by one registered nurse who indicated that staff irritation with the system

(i.e. the slow speed and user interface concerns) could result in reduced usage of the system, and thus missing documentation. The general perception seemed to be that the END could support the improved provision of quality care. This applied to the late interviews (30 months post-implementation at the rural supplementary site, and 12 months post-implementation interviews at the other sites) as well as at the earlier data collection rounds.

7.10 Effects of END on handover and verbal communication

Handover is a key part of a nurse's daily routine. It is a short (five to 30 minute) face-to-face meeting in which the nurse in charge of the work area in the outgoing shift communicates significant events and summarises residents needs to the charge nurse and other care staff whose shift is starting. In high care, it is one of the main ways that PCWs learn about the needs of the residents under their care. The length of the meeting should reflect the complexity of the residents' needs over the previous shift and the charge nurses' familiarity with the residents.

Because of its critical role in orienting nurses to their up-coming shift there has been research on the capability of END systems to improve the efficiency of handover. One specific goal is to limit the tendency of handover to run over time, and result in inefficient information sharing (e.g. Engesmo & Tjora, 2006). That handover could be slow and inefficient was a common complaint of many senior RNs at each of the

study sites.

At pre-implementation at the regional site, almost all staff were unsure or didn't think that handover and verbal communication would be affected by the END. There was some suggestion at the rural supplementary site and regional site that there was some reduction in verbal communication between professional nurses.

One train-the-trainer PCW at the regional site who was very enthusiastic about the END thought that it would improve access to information relevant to handover and thus gave a better overview the residents. However, this was not this person's subsequent experience at the six and 12 month interviews. The perceived lack of influence of the END on handover process in the long term in fact lead her to voice significant dissatisfaction about her job as noted in section 4.3.1.

Although the END did provide a shift handover feature, it was almost never used. The reason for this was because the design of the feature was not well matched to the way that care staff worked. There were three components to this. Firstly the software would report on all residents within a given unit – it was not possible to divide the handover up into the separate 'houses' that high care is usually comprised of. In itself this indicated a lack of ability for the software to account for the local spatial design of the home. Secondly, it is common in aged care that residents' conditions stay stable for a long period of time. Given that the continuity of care was reasonably good, this meant that much of handover was given to exception reporting. Thus, the fact that the report included all residents regardless of the need to report on them specifically at handover also detracted nurses from using this feature. Thirdly, that

the list of residents to be reported on could not be edited was also compounded by poor typographic design of the report. A hand-written handover report that was complete for a full caseload of residents would span one or two pages. By comparison, the much longer handover report generated by the computer was not seen as acceptable by nurses, as the report did not have sufficient information density. A lack of differentiation between unchanged residents, and residents who needed to be discussed in handover was a significant limitation with the electronic handover form. Attentional lapses caused by the long winded, undifferentiated reports could have resulted in communication failures. Thus not using the electronic handover report seemed legitimate and reasonable.

Verbal communication was seen to be critically important, and probably the primary way that care staff communicated with each other about resident's care needs, and meeting these needs. The RSM at six months, and LCTL at the regional site at 12 months provided interesting information about the process of handover. The regional LCTL at 12 months indicated that she was of the opinion that the role of verbal handover was either unchanged, or even slightly more important than before the introduction of the END:

> I still do verbal handover. It's probably more [important than it was before the END]. It is difficult to go through each resident [in the END] and pick out the salient points if you want to do it in 10 minutes. I don't know if staff are going [to ever use] shift handovers on the electronic system. That could be a bit more time consuming as you've got to go into the notes for 70

> residents. When preparing handover I'll ask people about what's happened on the shift rather than going through notes. When receiving handover, I go into the notes after the people who are mentioned in verbal handover.

The reason that the handover was more important before the END was probably not due to the system itself, rather the concurrent changes caused by the different funding system and introduction of the ageing in place policy (see section 5.1.4). Thus, the END only had a limited role in orienting staff at the beginning of a shift to the immediate care needs of residents.

The handover related issues detailed above also apply to more general verbal communication during the shift. The END system seemed not to change verbal communication patterns. That is, regardless of the contents of the END, verbal communication continued to be an important part of the ad hoc communication channels used to provide residents with appropriate and timely care. Although as mentioned previously, RNs at the rural supplementary site and at the regional site indicated that the END had caused a reduction in verbal communication between professional nurses with increased usage of the email system, although she did not identify consequences for care quality.

7.11 The END's impact on invisible work

Jackson and Jackson's 1997 article in the Journal of Nursing Studies on the identification of invisible work in United States nursing homes provides a useful classification

of the kind of work that invisible work constitutes. She divided care into two separate components. The first component is 'terms for care' which she divided into three categories: medical-technical care, personal care and emotional care. Medical-technical care concerned medication, wound management and pain management. Personal care comprised more items, but were divided into two categories: Routine and important care, and less important care done only if time permits. Emotional care also had two categories – emotional support (e.g. 'make them comfortable', 'wash their faces and hands') and 'treating them like friends' (i.e. 'visiting them', 'hugging them'). The second classification was attributes of care divided into family care: care for those needing help (subdivided into friendly helpfulness and nursing care) and care that requires training.

There seems to be an unstated assumption in Jackson's paper that the three classes of care work go from most-visible to most-invisible, with Medical/Technical care being completely visible work and emotional care being unacknowledged and unfunded. However the data from the rural site suggests that this is not the case. As mentioned in section 5.3.2, this home had a large secure unit with a LCTL who was interested in and committed to innovative nursing for dementia care. Therefore she had a strong interest in documentation for behaviour management. This seems to be because the management group gave professional nurses a reasonable amount of leeway to develop their own professional interests. However, as mentioned previously behaviour issues are only a minor component of the ACFI funding instrument, despite being some of the most important components of care work in the secure unit.

Nursing for behaviour management is also interesting in that it encompasses all dimensions of care. As well as medical/technical care (cognitive assessment, appropriate use of PRN [1] medication, personal care (e.g. assisting residents with orientation to time and place) and emotional care (e.g. dealing with episodes of disturbed behaviour and emotional turmoil). However from the perspective of the funding instrument this type of work was largely invisible. Because the END's primary goal was to support the funding and regulatory mechanisms, the software design did not take account for the need to support this important invisible work, aside from as a way of saving time when completing documentation.

Understanding how to design the software to improve work systems to support discretionary work (i.e. that done when time is available which is a large component of invisible work, and an important part of a good carer's job) or specialist documentation needs is an interesting and open question worthy of further research.

7.12 External relationships, allied health and medical doctors

There were three main types of information exchange with external providers. These were results of interactions with allied health workers (mostly physiotherapists), information required for transfer to hospital, and the recording/followup from consultations with visiting doctors. Only very limited information was provided by interviewees

[1] PRN *pro re nata* – Latin for 'as necessary'. Medication directed to be given to a patient as required, usually up to a maximum daily dose.

about hospital transfers and allied health consultations as conversations about external services were usually steered towards the subject of visiting doctors by the interviewee. However the change in documentation system, and working out the most appropriate way to manage interactions between visiting doctors and the END was often discussed in the interviews. Note that it can be difficult to get General Practitioners (GPs) to visit RACHs for a variety of reasons related to GP workload and how consultations are funded. Thus as well as there being difficulties to getting a GP on site in the first place, requesting that they use possibly unfamiliar computer systems during their consultations adds another potential barrier. As with the implementation plan, the rural and regional sites took similar approaches to managing this. The rural supplementary site took a different more structured approach.

Before discussing the results, the relationship between nursing documentation and medical documentation needs to be explored. Following this, a description of how visits from medical practitioners are managed at each site will be presented. Finally how this management affected the visiting doctor's documentation work at each site.

Finding a simple written statement of the difference between nursing and medicine in the literature is surprisingly difficult. A discussion with a retired senior public health physician (E. Haworth, pers. comm.) resulted in the following description:

> While the boundaries between nursing and medicine are becoming less rigid than in the past, nursing is protocol driven, and nursing documentation is frequently audited in order to ensure that the relevant nursing protocols are being applied. By contrast, medical practice is driven by theory,

diagnosis and treatment. Nursing training is less onerous than medical training. This is reflected by the greater importance of theory for medical practitioners, and their greater professional autonomy. As a result, medical practitioners are more likely to give nurses instructions than vice-versa. Medical practitioners have more professional power than nurses, and take on greater legal liability. The latter is reflected by the high price of their indemnity insurance. However, nurses and doctors do not work independently. In hospital settings, nurses and doctors have continuous face-to-face interactions, and operate variations on a ward round system for exchanging information. During a ward round, the medical team and nursing team meet together and review each person in their care during a formal meeting. Actual ward round practice varies between units. It can comprise a series of bedside meetings with each patient, or it can be run out of a meeting room with limited patient interaction as a series of mini-case conferences.

Medical visits in RACHs are frequently more ad-hoc than in hospitals. This can be due in part to the difficulties of organising doctors' visits. The local variations in practice at the study sites are discussed below.

7.12.1 Rural site

At the rural site at pre-implementation, the DRSM anticipated problems from talking to doctors, trying to persuade them to use the system. There seemed to be an unstated

assumption that it was best for doctors to document in the END. She anticipated that one fifth to one third of doctors who visited the site would be happy to use the system. There was no obvious strategy for improving engagement with medical practitioners at this time. At pre-implementation the professional nurses and the managers thought there were a number of barriers to getting better participation from doctors. The most obvious were a lack of system integration with medical information systems and political issues with local Division of General Practice. That is the local division and the management group seemed not to have formal systems in place for the delivery of primary care to local RACHs. This is in contrast to the rural supplementary site's relationship with its division, which is detailed later.

At six to 12 months post-implementation the DRSM indicated that there was a small decrease in resistance. The rural site had one medical practitioner who was the nominated GP for around 20% of residents (i.e. around 25 patients). In order to integrate with her medical information system, she wanted to use her own laptop, and an internet connection. This gave rise to significant difficulties for site managers. Unable to connect her laptop to her medical information system via the RACH internet connection, she was reliant on a 3G mobile internet connection which was unreliable on site. After several trials, the RACH found a room that had acceptably reliable 3G reception, but this restricted the availability of her documentation system during consultations. If visiting residents in their bedroom, she would be unable to document at the point of care – a usual practice for GPs, otherwise the resident would have to visit the consultation room. Depending on their health status, this could require care

staff for mobility assistance.

The second problem was the coordination of medical and nursing documentation. That is, at this site medical notes would not generally be recorded in the END. This would then require a paper note from the doctor in the resident's paper file, or for a nurse to transfer relevant information into the END. The RN previously mentioned in section 5.3.2 dealt with this problem by running an informal ward round system with the above mentioned visiting GP for high care consultations. Part of the reason for this seemed to be the good relationship between this particular RN and the GP. That is she would record nursing documentation in the END that arose from the medical consultation, and generally participate in the GP's visit. This informal ward round-like system with a doctor and a nurse both participating in all medical consultations seems to be an example of good practice in homes without more formal arrangements.

However this only occurred for this doctor and this nurse. Thus the system was fragile and only dealt with a minority of medical consultations on the site. No such mechanism was used in low care and secure care. This lack of a formal system may have contributed to the high levels of frustration with medical visits reported by the LCTL and her staff. The reason for the frustration was that the use of mostly paper notes by visiting medical doctors resulted in further fragmentation of the END. This was compounded by the fact that the low care unit was already experiencing problems with the system not meeting their needs for the documentation of behavioural care.

Among the PCW staff in both high and low care, there was an awareness that the management strategy was not effective in encouraging comprehensive use of the

system by visiting doctors. Apparently unable to do anything about this themselves, there was an awareness of risks of significant clinical consequences caused by a dual electronic/paper documentation trail.

7.12.2 Regional site

At the regional site, at pre-implementation the RSM was confident of good usage of the END by doctors. She attributed this as being due to prior experience with electronic systems in other nursing homes. The other managers and professional nurses were also confident of this. At 12 months the RSM said that the "doctors are all participating, radio doctor, allied health. eight or nine doctors are visiting, and they're all using the system. The doctors got on board straight away. It wasn't a problem. It was the same with physiotherapy, the dietitian, speech pathology". However, there were complaints about the lack of integration between the END and the doctors own medical information system from RNs and low care PCWs, causing the visiting doctors to be reluctant to use the local system.

At six months post implementation, the RSM reported that the benefits of usage of the END by doctors was clear. These benefits were easier retrieval of medical information, and better medical management and follow-up of residents. The RSM described a strong desire for better (presumably automated) system integration between the END and the medical information systems. Future integration of medical, pharmacy and nursing documentation as part of the home's documentation system seemed to be a priority from the regional RSM. The RNs and nurse managers indi-

cated that use of the system was not presented to doctors as a discretionary choice. That is, rather than being asked to use the system, doctors were generally politely told that the new system was what everyone was using, and were encouraged to follow suit. Therefore while the doctors did have a choice in using the system, it was not presented to them as such. This assertive management style seems to have prompted doctors to use the END during site visits despite the lack of a formal process for managing medical visits. PCWs had limited involvement with medical information in the END, although some perceived that the electronic system could be beneficial for visiting doctors, without describing why this would be the case.

7.12.3 Rural supplementary site

As with the other aspects of implementation, the approach taken at the rural supplementary site was quite different to the other sites. At this site, as mentioned previously there was initially a low number of residents, which made the workload more manageable during the establishment of the home. As well as this there was a good, cooperative formal relationship with the local Division of General Practice. The unique geographical features of the site's region (the town the RACH is located in has one main access road and is the last town on the edge of its region) meant that the number of available GPs was quite low. Thus it was important for the RACH to have good working relationships with them.

As part of the introduction of the END system, the DRSM at the rural supplementary site had ensured that the home had a reliable internet connection to the

visiting doctor's surgery. Provision of an internet connection for visiting GPs was clearly possible at the rural supplementary site, so it was not clear why it was not possible at the rural site. It probably reflected different strategic behaviour and a knowledge of computer technology among management at each site. The visiting GPs could use their own patient systems while visiting the home. Meanwhile, the DRSM also ran a ward round-like system such that she or an RN were in attendance for all medical visits. In this way the supervising nurse was always in charge of follow-up nursing documentation.

This ward round-like system seems to be successful because the process delineates writing in nursing documentation as a nursing task and writing in medical documentation a medical task. That way, both medical and nursing issues get simultaneous consideration, and any coordination of resultant documentation can be dealt with at the point of consultation.

However, medical visits can be organised quite differently at each site. Where medical visits are less formal, as at the rural and regional sites, there was some ambiguity about where a medical practitioner should have put follow up information. That is, should they use their own system, should they use paper notes to be left at the RACH or should they use the local END? While the difference between the participation rates at the regional and rural sites seemed to be a matter of presentation – i.e. presenting doctor's END usage as a choice, or as a requirement – the regional site's process seemed to be the most efficient due to the more formal arrangement.

7.13 Discussion and conclusion

Impact on work practices for managers was greater than that for care staff due to their administrative role. For other staff the impact on work was roughly in line with the number of residents that they had responsibility for. That is the LCTL, RNs and to a lesser extent, low care PCWs needed to maintain and review information about relatively a large number of residents. Thus the END's impact on work practices is significant for those staff. High care PCWs have more intensive involvement (i.e. direct care) with fewer residents. Due to this and the nature of the work they do, there is little impact of the END on their work. Having said this, due to the enthusiastic uptake of the system, and the mandated daily work (i.e. bowel charts) for high care PCWs at the regional site, their awareness of the system was quite good. However, although the LCTL and RNs' work reviewing residents was made significantly easier with the END (despite some user interface problems), there seemed to be few other examples of the END helping with care provision.

The END was not reported to have a significant impact on handover or other verbal communication between care staff. Given the great importance of verbal communication in the RACH environment (Munyisia, Yu & Hailey, 2011b), this was probably a good thing. Research into non-verbal, written or computerised handover systems are at early stages (Sarvestani, Moattari, Nasrabadi, Momennasab & Yektatalab, 2015; Strople & Ottani, 2006). It may be that it is desirable to avoid technology mediated changes to the handover process until the effects on work were better understood (c.f the conservatism of the aged care sector noted in section 5.1.1). The fact that this

system did not have an impact on handover may have been accidental, rather than by design, due to a perceived focus of the software vendor on supporting regulatory requirements for an administrative tool, not a tool to support care directly. This quote from the rural LCTL at twelve months illustrates this perception:

> We've gone back to a lot of paper forms because they're just not practical [on the computer]." "ACFI should be at the end of it, it's not the main thing. It's an accountant's tool not a nurses tool, and it's got to be a happy medium.

This close link to the administrative function did seem to create problems in the environments where invisible work was seen as central to the provision of care.

Although the END did not have a large effect on day-to-day hands on care, it did have an effect on the workflow of visiting doctors. This is because it changed the way doctors retrieved nursing information. It seems clear that in terms of the definition of responsibilities, and understanding how to deal with documentation generated during medical visits, a formal ward round like system is better than more informal ways of encouraging doctors to use the END. The alternative to this, which is to risk a mixed paper/electronic system appeared to cause problems at one of the study sites.

There were clear advantages for the management management to take a very structured implementation with clear delineation of responsibilities. The provision of a management training system to encourage an assertive approach to implementing an END system, and encouraging site leadership to have a clear vision of the aims of the

END may be beneficial. More research into understanding on how to use the END to support care as well as administration should be performed.

Chapter 8

Discussion and Recommendations

The goal of this research was to evaluate aspects of the organisational changes associated with the switch from paper based to electronic nursing documentation. I used an interpretivist, heuristic of analysis (Greenhalgh et al., 2011) rather than the the usual inductive approach most often used in health informatics evaluation research (see section 2.7.1.1). Data were collected from workplace interviews inside the Residential Aged Care Home (RACH) in an environment where health workers continued to deliver day-to-day care to older people. The focus of the research was on elucidating the managerial issues from an operational rather than a strategic perspective. This is appropriate since the intention of the introduction of the Electronic Nursing Documentation (END) was to provide operational benefits.

Each of the sections in this chapter addresses research questions outlined in chapter 1. They have been divided into situating, grounding, diagnosing and resolving themes as per chapter 2. While this provides some structure for the chapter, is at

times contrived. The approach has been used to create imposing some order to the findings while acknowledging that trying to translate "the messy world into an ordered measurable system is misplaced" (Charles & Dawson, 2011).

The major challenge of this research as been to reconcile the large and disorganised literature on organisational change (see section 2.2.1), and find a way of reconciling that with the very limited amount of work done on organisational change in health informatics (see section 2.6 and section 2.7). Consequently there are few points of comparison to previous research in this chapter, rather the I discuss the research results with the aim of providing an empirically rich, context-specific account of my findings, and present recommendations for practitioners and action researchers evaluating the introduction of electronic documentation systems.

8.1 Context

8.1.1 Situating

In general interview participants had a positive view towards the role of computers in the workplace, but as shown by Eley et al. (2009), beyond making some administrative jobs easier, many nurses were unsure of the direct benefit that the introduction of computers had for their work. The executive managers became aware shortly after initial implementation that anticipated ability for staff to be able to perform documentation at point of care could not be realised (see section 5.1.1)

To some extent the END had been imposed by managers onto a willing workforce

without sufficient understanding by them of how staff engaged in direct care used the computer system. As shown in section 7.3, the benefits of the END for supporting direct resident care were limited.

8.1.2 Grounding

Data collection by staff interviews, to investigate the scope of my evaluation began with a representative sample of all staff undertaking care responsibilities in the RACH. As the study progressed, my sampling frame contracted to concentrate on those who were regular users of the END. For example in the early data collection stages Recreational Activities Officers (RAOs) were interviewed at each study site. It became apparent that although many RAOs had been trained to use the END and had been expected to use it, the software actually lacked features to enable them to use it conveniently. There was a lack of facility for entering data for more than one resident at a time. This also affected the utility of the system for high care Personal Care Workers (PCWs) – see discussion of bowel charts in section 6.5.1.1. From my literature review, understanding the importance of providing different styles of data entry screens is an under-researched area.

This issue can be explained by a top-down approach. It is usual for the software developer to prioritise cost effective software development to support the most pressing interests of the product buyers. In this case the product buyers are a combination of executive managers and care managers, and the software is designed to support the administrative function of the site and compliance with regulations (see section 7.6).

The limited ability of the software to support the care function of the homes is due to assumptions made by the software vendor, without adequately consulting those providing patient care. Managers seem to have overlooked this critical requirement of consulting care givers as well as clinical care software experts.

The user interface problem caused by overlooking the need for flexible data entry (e.g. being able to aggregate data entry for multiple residents on a single screen) by the software vendor was a part of a broader set of problems, for example the lack of facility for documenting invisible work and behavioural care. However the END was very successful at all sites for supporting funding, accreditation and administrative requirements, recording exceptional events and reporting on resident's progress, as well for tracking the professional work of Registered Nurses (RNs).

8.1.3 Diagnosing and resolving

Thus the effects on care were indirect and emergent (Diment et al., 2011), rather than direct effects to improve care by design. By examining the more successful implementations in the homes I studied I have shown the importance of understanding the initial conditions at the start of the implementation, had an influence on the course of the introduction of the END, to better understand the reactions to computerisation at different levels of the organisation.

8.2 Research question one: factors leading to successful outcomes

8.2.1 Situating

Both positive and negative outcomes were identified by direct questioning of RACH staff such as asking what their favourite aspect of the END was and if the software was used well at their site. This fits the materialist approach to enquiry described in section 3.1.

8.2.2 Grounding

Those staff with most contact with residents experienced least reason to use the END. The most successful outcome was at the regional site, where there was near-universal usage. By contrast, where floor staff were given the least mandated use of the system (e.g. no reason to fill out the electronic bowel book), problems occurred. At the rural site, there were quite high levels of dissatisfaction about the quality of the information to support care that came from the END, therefore more staff resistance to using the END. Some of this can be explained by the importance given to managing behavioural care and other invisible work not captured in the END.

At the rural supplementary site, a lack of training of many staff for the new system created an ongoing problem. Regulations require that observations are documented by the member of staff who made them, and the way that the documentation was implemented at the rural supplementary site, this was not always possible. Although

this problem became apparent over time, it did not seem to create an immediate impact on the quality of the documentation as observed during data collection, and staff satisfaction seemed to be high. In fact, according to the interview with the rural supplementary Deputy Residential Services Manager (DRSM) in section 6.2, the restricted usage was implemented specifically to ameliorate problems with the quality of nursing documentation. This conflict between quality and universality is an interesting finding, worthy of further research.

Dissatisfaction at the rural site seemed to be a much bigger problem. A salient comparison between the rural and rural supplementary site, that may explain the difference in the two sites' experiences is in the way that medical information was handled. At the rural site, there was a relatively *laissez-faire* approach to coordinating medical and nursing documentation (see section 7.12.1). As a result, many staff doubted their reliable access to information on medical consultations without having to search both paper and electronic systems. Contrasting with this, at the rural supplementary site, the systematic ward-round style of medical consultations meant that doctors' and nurses' notes were available reliably via the END, and information was unlikely to be lost.

A similarly *laissez-faire* system to the rural site was operating at the regional site, but without expressions of the same concerns. At the regional site, the commitment of all staff to using the END was high, and all staff were required to make regular use of the system. It seemed that the Residential Services Manager (RSM) of the regional site had succeeded in persuading more doctors to use the END than was achieved

at the rural site (see sections 7.12.1 and 7.12.2). High levels of usage of the system meant high satisfaction about the END at the regional site. This finding is consistent with that of Ammenwerth, Mansmann, Iller and Eichstädter (2003b) who found in a questionnaire study that acceptance of a nursing documentation was moderately positively correlated with years of computer experience. However their study did not find that the acceptance changed over time post-implementation. Although my research is qualitative, and so there is no robust measure of changes over time, my results seem to support Ammenwerth et.al's findings in that while increasing familiarity with the END seemed to cause increased enthusiasm for it, this did not seem to increase over time.

8.2.3 Diagnosing

At the regional site the RSM had very high levels of interest in information technology (IT) and in using it well. Because of an accreditation near-miss (see section 5.3.1) the conception of the need for change was high, with mandatory use by staff, and good efficient staff training to achieve this.

At the rural supplementary site the DRSM showed a similar high level of interest in IT. However rather than there being a conception of the need for change, this site was implementing a documentation system from scratch. Rather than aiming for universal usage at this site, fewer people used the system in order to efficiently use resources during the initial roll-out.

At the regional site where managers had less interest IT, the training programme

was provided at the same time as accreditation, and there were insufficient Train the Trainer (TTT) trainers available to train the other staff. Therefore, staff training was inadequate. This and the failure to mandate use of the END by all PCWs meant that the levels of resistance were high.

8.2.4 Resolving

Despite the problems experienced at the two rural sites, the new software was appreciated as an administrative tool that greatly streamlined the resident funding process. Apart from meeting this need, outcomes at the three sites were varied. The conception of the need for change (see section 2.7) appears to be a very important factor. When rolling out a new system like this, IT managers should assess affected staff's (particularly site managers) commitment to the need to change, and adapt roll-out planning accordingly. For example where the need for change is inadequately perceived, greater initial training to managers on IT introduction is likely beneficial.

8.3 Research question two: sensitivity to initial conditions

8.3.1 Situating, grounding and diagnosing

The local variations in training approach and managers' commitment to the use of the system were important factors affecting how staff felt about the END. Thus the

regional site site which had the highest usage by all staff had the greatest understanding of the need for radical changes to the documentation system. This was due to coming close to failing the information systems component of the last accreditation review when the previous paper-based system was in place(see section 5.5). This site also had the major advantage of its proximity to the head office, and easily accessible training support. It may be, that the distance from head office created a resource disadvantage for the rural sites. Both at the rural and rural supplementary site it seems that a pragmatic solution to their limited resources was to slow the pace of staff training.

Though the commitment of the DRSM at the rural supplementary site and the DRSM at the regional site to introducing the END was similar, there were two major differences between their implementation strategies that may relate to the different outcome. Firstly the regional RSM was committed to and perceived clear benefit from having as many staff using the END as quickly as possible. The rural supplementary site's DRSM wanted a slow introduction of the system with only few staff using it initially. Thus they appeared to have quite different strategies.

The regional site RSM had the more flexible vision for the END as evidenced by her repurposing the resident records in order to extend the its functionality (see section 6.2). This flexibility reflected a different reaction to the introduction of the END compared to managers at the other sites, as it represents a flexible, changing view of the software's capabilities. In this case it represents "premise control" Weick (1990, see section 2.7) in that the RSM expanded the vision of the original software

designers by repurposing features of the software in ways that they had not foreseen.

While it is possible that these differences may reflect the attitude of the two managers as to how best to utilise the END, it may also be that the urgent requirement to improve the regional site's problematic paper documentation provided a strong incentive for a comprehensive and inclusive introduction of the END. Staff at all levels would have had knowledge of the old documentation system's problems. Therefore, as well as the site manager's enthusiasm for electronic documentation, staff perceived an urgent problem in need of resolution. The END offered a solution that was accepted wholeheartedly.

Comparing this to the rural site where a paper based system, by all accounts was functioning very well indeed (see section 6.2), there was no widely perceived need for change. This seems a credible explanation for the reluctance of the rural site to change its existing paper system. Staff apparently saw a new electronic system as a big challenge without a clear implementation plan.

8.3.2 Resolving

These results suggest that understanding the RACH background and pre-existing documentation system impacts on the END implementation. In particular, the site managers' awareness of the magnitude of changes required with resourcing the implementation was critical. By ensuring this awareness, executive managers and project leaders can mitigate risk of failures in the implementation process by proactively dealing with potential problems in advance.

8.4 Research question three: reactions at different levels of the organisation

8.4.1 Situating

The final research question sought reactions of the different internal stakeholders to the introduction of the END. This comprises the views of the executive managers, site managers, professional nurses, PCWs and the ancillary and allied health staff.

8.4.2 Grounding and diagnosing

8.4.2.1 Executive managers

The views of the executive reflect the governance of the RACH, i.e. the regulatory and fiscal requirements. The main concerns of the executive were that the END maximises efficiency and effectiveness, particularly with respect to the link between service provision and funding. This contributes to the conflict between invisible care work (e.g. behavioural care – see section 7.4.2) and the clinical utility of the END, indicating that misalignment between regulation and care work. Thus the perceived success outcome for the executive managers and the care workers clash. This can be explained by the executive management as the primary customers for the software vendors, failing to consult with the care workers who are the primary users of the software. Successful END software must take into account care workers' views so that the chosen system really supports care as well as administrative function.

8.4.2.2 Site managers

The primary concern of the site managers is to provide good care of residents through a professional work ethic, appropriate staffing levels, in an environment where good performance of care duties is both acknowledged and rewarded. Reporting via documentation and verbal communication in an accurate and timely manner is an important component of this. the reputation and therefore the viability of the care home depends on achieving care standards as well as good patient records. With respect to the documentation system, substantial leadership and commitment to the END is required to ensure that it is well aligned with both regulation and care. The case studies indicated high levels of variability in the attitudes and activities of each site manager than might be expected, indicating that local variations in the IT implementation approach were an important factor. The differences between sites were mainly the varying attitudes of the site managers especially to the need for change. Where this was lower the site managers were less committed to the system, and there were more difficulties for all staff in adapting to the new ways of working.

8.4.3 Professional nurses

Professional nurses are care providers with supervision responsibilities for the PCWs working under them. Professional nurses are generally given reasonable levels of professional autonomy in order to achieve their goals. Their attitudes to the END also varied and seemed related to the individual nurse's attitude to their job. Some nurses view their job as primarily being a care provider. These nurses tend to take a rela-

tively collegiate view of their duties with respect to managing the PCWs under their charge. Other nurses are of the view that their primary function is coordinating care and providing professional expertise - being a care facilitator. This group tend to have a less collegiate view of managing PCWs. The variation in attitude was seen in both Low Care Team Leaders (LCTLs) and RNs, so seems to be a function of the perception of the job role rather than caseload composition.

Positive and negative views of the END were seen in nurses with both attitudes. For the nurses who tend towards the care provider view of their job the END can be seen as imposing extra irrelevant administrative work on care, or it can be seen a valuable tool to promote inter- and intra-team communication. For the nurse as care facilitator view, the END can either be seen as insufficient to provide the quality of information required, or it's as a valuable tool that helps ensure the viability of the RACH.

Understanding these different views of a nurse's role, and how their professional discretion is exercised – in combining the administration and care coordination of the END requires further research to understand its relevance and importance.

8.4.4 Personal Care Workers

For PCWs professional autonomy is quite low, even within the team of a more collegiate professional nurse. PCWs have some autonomy over direct care, in that they have some discretion in the way care tasks are performed, but generally do not get the opportunity to choose what care tasks are provided because they work under the close

direction of the nurse in charge of the shift. Therefore their attitude to documentation in each shift is highly influenced by the RN in charge. For those situations where the perceived utility of the END was not well aligned with the care function, this is a potential problem as discussed in relation to medical notes at the rural site in section 7.12.1). A way to overcome this is via the persistent repeated use of the system as seen at the regional site. Although the time used to comply with the electronic bowel book recording seemed inefficient (see section 7.7) it did increase the awareness of, and enthusiasm for the END across the entire site, and broke down the scepticism of professional nurses. This did not improve the clinical utility of the END for these nurses but habituated them to the use of the system, encouraging wider usage of the END at the site. In order to try to fix the cause of this problem, the user interface of the software might benefit from a design less focused on regulatory compliance, and more geared towards the workflows used by care staff.

8.4.5 Ancillary, allied health care staff and medical practitioners

After the initial rounds of interviews of all staff categories were including RAOs, it became clear that for the high caseload of RAOs, the lack of specialist forms in the END for their work, impaired the functionality of the system. Inability to aggregate data entry, meant that the system was not useful for these staff. Therefore, RAOs did not record work activities or resident interactions in the END. With respect to the regulations for residential aged care, this is entirely within the requirement. Nursing

and RAO records are independent of each other, and are not required by regulation to be considered together. However better integration would improve efficiency. Having the RAOs complete part of the record would produce searchable and storable records, which could be used together with progress notes, care plans and assessments. One obvious benefit would be to help staff better understand and manage behavioural care by bringing together a wider range of care observations.

Allied health workers (for example physiotherapists) differ from RAOs, as they interact with one resident at a time. Data entry was done either directly into the system by the allied health worker, or given to a charge nurse who arranged for data entry. Thus visiting health workers' usage of the system closely followed that of the nurses they worked with. It appeared that at all sites, allied health workers usage of the END was straightforward and successful.

Visiting doctors' usage of the system by contrast was dependent on the way the END had been introduced at each site. Medical care is usually more complex than allied health care because it is more likely to represent a change in the overall status of residents' general health. Medical practitioners often used their own practice information system that did not integrate with the RACH's system. Some medical practitioners were not prepared to do double data entry – once on the RACH system and once on their own. Especially at the rural site this resulted in mixed paper/electronic system for medical documentation. Some medical practitioners were neither persuaded to use the END. The lack of a strategy for integration of medical notes in to the END seems to have been the main barrier here. As previously, the con-

ception of the need for change may have been the main factor for success in including medical information into each home's END. At the regional and rural supplementary sites where the conception of the need for change was high, different strategies were used to ensure that medical information was entered into the END. Although at the regional site this was left up to visiting doctors to choose to use the system or not, it seemed that the greater use of this system by all staff including visiting doctors was because of an enabling and cooperative culture.

8.5 Research contribution and recommendations

My research has contributed to the field of health informatics by exploring behaviour and attitudes of an important subset of the care workers in a group of RACHs using semi-structured interviews. This entailed understanding the management arrangements in different care settings of different sites undergoing similar health IT implementations for the first time. I developed a coherent view of how different stakeholders' needs are met, not met, partially met or not at all met. I have provided recommendations and a starting point for further research by providing an improved understanding on what RACH staff's needs are with respect to the alignment of IT systems, their training requirements and an approach to investigating those needs. My research contributed to the field of health informatics as follows:

- I undertook a comprehensive literature review to describe prior organisational focused work on understanding organisational issues caused by introduction of

the END

- I devised the methodology for the research and consulted on it
- I modified a pre-existing interview proforma based on the information system success model (DeLone & McLean, 2003) and modified it for better use in understanding organisational research
- I recorded, transcribed and analysed interview data, including writing software tools to ensure reliable, valid and auditable data analysis (Diment, 2010)
- I presented findings to the study RACHs, at conferences and school seminars (see Appendix)
- I have written a final detailed report for submission to the examiners for PhD

When I began this research, there were examples in the literature of conducting evaluation research for health informatics, and an enormous "sprawling" (Weick & Quinn, 1999) literature in organisation studies. However the only work I found to help me to structure my research on the kind of multi-site, exploratory research in health informatics that is presented in this thesis was that of Lorenzi and Riley (2000). My findings are consistent with Lorenzi and Riley enumerating reasons for system failure summarised in their table 1. I believe my research confirms that those issues related to communication, culture, underestimation of complexity, scope creep, organisational issues, technological issues, training and leadership are all important and relevant. I also believe that under the organisational issues umbrella of those reasons I have

identified another factor which is failure to understand the plurality of points of view in the organisation. That is, what individual stakeholders would like to realise from the system to better understand how software design, and management are able to meet these needs. Where the system may get in the way of accommodating this plurality may contribute to failures in system implementation. Helping managers understand these issues via a continuous improvement process which is less labour intensive than transcribing, annotating and analysing extensive staff interviews would be an important, substantial area for further research outside the scope of my thesis.

The reason that understanding system failure is not a central theme of this thesis is that my brief was to examine how the implementation unfolded, successes and failures as they arose, without anticipating positive and negative outcomes in advance. For setting this as a starting premise, I found the work by Watzlawick 1974 particularly intriguing in its application of symbolic logic for understanding how to formulate problems around change. After a significant investigation, I decided that understanding change derived from a theory of logical types (Diment, Garrety & Yu, 2011) was too abstract to make solving my research problems tractable. The heuristic approach described in Greenhalgh et. al 2011 achieved a similar goal through observational rather than theoretical means. While Lorenzi and Riley's work helped me to situate my research problems, Greenhalgh, et.al helped me towards a resolution.

The close coupling of the software to the financial and regulatory aspects of care provision in the RACH helped make the END a success at all study sites, as it was designed from the outset to streamline funding administration. This simplified the

management of resource allocation. The experience of at the regional site RACH demonstrated that with committed and knowledgeable management, getting a large and diverse staff with highly variable computer skills to adopt the END with enthusiasm was both possible and associated with multiple positive outcomes including career enhancement, consolidation of much documentation into a searchable database, improving accessibility of documentation, and occasional career opportunities for staff such as Aged Care Funding Instrument (ACFI) coordinator roles.

The regional site's introduction was particularly successful, with universal usage, general enthusiasm and management who strongly advocated maximising the utility of the END. Frequent repeated use of the system by all staff generated commitment to the system and confidence in using it. Managers' attitudes at the rural supplementary site were similar to this, although enthusiasm was engendered by having a core group of users with high levels of responsibility for system success.

The three most important implementation problems I identified were with the pace of introduction, degree of enthusiasm, and universal usage of the END. There were problems in the pace and enthusiasm towards the introduction of the END at the rural site, and problems with universal access and usage at the rural supplementary site. These problem reflect on management's leadership and ability to anticipate and account for multiple points of views. The following are recommendations to help stakeholders to understand the diversity of viewpoints within the organisation.

The END was most successful in simplifying and streamlining the admin- istration of resident assessments and funding. However this is a single domain within the

RACH, and the potential benefits in improving the quality of care did not seem to be realised.

When procuring software, managers should be aware that while they are the purchasers of such software, the perspective of the end-users should be given full consideration. Failing to consider end-users and the benefits they may wish to see from such a system and the way they end up using the system can exacerbate resistance, and can lead to missed opportunities such as efficiency of data entry and utility of data retrieval.

There have been substantial changes in computing since I conducted this research. Computer technology in 2015 is much more widely than it was in 2010. Handheld computers with touchscreen devices have become a reality. These have caused people's expectations of the utility of IT to rise substantially. As computing continues to become more pervasive, ensuring that managers understand the plurality of the possible points of view about the usage of electronic health records will become increasingly important.

Further research is required to streamline the evaluation of information system development in a less labour intensive manner. Simultaneously questionnaire or micro-sociological research more typical in health informatics research can create tunnel vision and fail to identify unexpected broader issues. Development of an action research approach is needed to identify, produce and implement explicit protocols to ensure that the right data are collected, in order to achieve continuous improvement of patient care. This should also acknowledge anticipated and unanticipated problems.

8.5.0.1 Recommendations

From my study I make the following recommendations to help stakeholders and other researchers to engage all user views and avoid future problems.

- Better understand the different possible implementation styles, and how managers can expect staff to discharge their documentation responsibilities.
- Create strategies to deal with the challenges of constrained resources uses, especially with respect to the training programme (see section 5.4).
- Make staff's requirements for use of the END are clear, and that managers options for system implementation consistent.
- Ensure that training is adequate and timely, and not derailed by other unanticipated events such as sickness, staff turnover and new administrative priorities.
- Provide sufficient time to overcome resistance to the new system, and ensure that staff understand the importance of the system to their organisation.
- Identify and educate site managers and team leaders with limited experience of and/or enthusiasm for information technology to prepare them for challenges in training and widespread adoption of the END.
- Build evaluation into future system reviews so that this is automatic, less labour intensive and quick to identify problem areas.

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Appendices

Appendix A

A Preliminary Investigation of Complex Adaptive Systems as a Model for Explaining Organisational Change Caused by the Introduction of Health Information Systems Diment et al., 2011

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A Preliminary Investigation of Complex Adaptive Systems as a Model for Explaining Organisational Change Caused by the Introduction of Health Information Systems

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Abstract
This paper documents the preliminary development of a framework for evaluating organisational change processes during the implementation of an electronic nursing documentation system in residential aged care facilities. It starts with a brief outline of organisational change processes. This is followed by a more detailed exposition of the principles underlying complex adaptive systems (CAS) theory, where we explain how mathematical concepts can be used to illuminate qualitative research approaches. Finally we present some preliminary findings on the facilitators and barriers for the introduction of the electronic documentation system, explained with reference to the CAS theory, based on analysis of interviews with care staff members in a residential aged care facility. While there are clear benefits from electronic nursing documentation, we also identified significant risks, and possible unintended consequences, both positive and negative.

Keywords: Organizational Change, Nursing Records, Nursing Care Management, Complex Adaptive Systems, Residential Aged Care

1. Introduction

This is a report on the preliminary work examining changes associated with the implementation of an electronic nursing documentation system in a number of aged care facilities in South Eastern New South Wales and Queensland. The research reported in this paper is the beginning of a multi-organisational study of multiple sites within each organisation examining the change management practices and their consequences. In a sense this means that we have a natural experimental system with an unbalanced block design, although our research is not a formal experiment. To understand the change management issues arising from the implementation, our analysis is conducted at two levels: the variation among sites within each organisation, and the variation among the partner organisations. At this stage we have conducted interviews with nursing staff at all levels at a single site. This paper documents our theoretical approach to interrogating data about change based on the theory of complex adaptive systems approach [1]. It provides a case to show our approach at one aged care organisation.

Nursing documentation is a part of the clinical information stream in nurses' every day work. It provides a systematic process for nursing practice encompassing assessment, definition of patient problems, recording of nursing aims, planning of nursing tasks, execution of these tasks, and evaluation of care and care planning [2]. The perceived benefits of electronic nursing documentation systems in aged care are freeing up carers time by streamlining the process of documentation, improving its accuracy, and allowing more time for direct care. However

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scientific evidence for this perception is lacking [3]. Understanding the processes of change and how the actions of individuals and collectives effect the changes which occur when electronic nursing documentation is introduced into residential aged care facilities can help identify the variables and underlying processes that can help lead to answers to the above perceptions. As well as providing a triangulation for the scientific findings concerning the implementation of electronic nursing documentation, a full-scale qualitative, ethnographic exploration of the change process can reveal the causal relationships and outcomes of introducing the electronic nursing documentation system into an organisation. In order to develop the framework for evaluation of organisational change process, the components of organisational change is first reviewed.

1.1. Components of Organisational Change

The study of organisational change in health informatics can help inform the decision making process. Lorenzi's seminal article [4] outlines the issues related to change that occur during implementation, which may influence the trajectory of success and failure. Lorenzi notes that these concepts are not easy to define, as they can be framed in terms of success/failure, or more general ideas of process. The non-linear trajectory of change, and its significance in explaining change, is also worth noting: the non-deterministic nature of change, and that similar starting conditions can result in substantially different outcomes helps elucidate the value of context within the situations under study [5, 6].

Organisational change can be seen as encompassing three components: people, culture and processes, defined as follows:

- **People** - demographics, structure of the workforce, educational background, and dispositional factors such as motivation, personality and performance
- **Culture** - values, leadership, and workplace rituals
- **Processes** - documentation, work routines, and chain of responsibility

These components overlap. For example in nursing practice, handover is a central process for the sharing of knowledge and dissemination of information. However, it is also an essential part of workplace culture. The personal dimension is also important in shift handover – here an individual registered nurse is in charge of delivery, and the personality and professional skills of each staff member can influence the process.

The rich interactive nature of the workplace manifested through business processes such as handover are difficult to make sense of, because they can have unpredictable consequences. At this point we discuss Complex Adaptive Systems (CAS) theory, and the way that this ontological framework can help to make sense of the change phenomena under investigation.

1.2. Complex Adaptive Systems – Complexity, Chaos and Entropy

Macquire et al. [7] give a detailed definition of complex adaptive systems: *"A complex [adaptive] system is a whole comprised of a large number of parts, each of which behaves according to some rule or force that relates it interactively to other parts. In responding in parallel to their own local contexts, the parts can without explicit inter-part coordination or any one of them having a global view [although a global view, or partial global view is not mutually exclusive to complexity], cause the system as a whole to display emergent patterns at the global level – the emergence of orderly phenomena and properties of the whole that cannot be predicted from properties of parts".*

This theory has its roots in mathematics, and as a result its components are very well defined in a mathematical sense. One important aspect of complex adaptive systems are emergent properties, one form of which is unintended consequences. The challenge for social researchers wanting to use this framework is translating these mathematical ideas into concepts amenable to qualitative analysis. High levels of uncertainty with respect to the precision with which variables or situations can be identified, measured and assessed are also problematic. One approach to CAS is to use biological ecosystems to illuminate organisational processes. Dooley's paper [1] is perhaps the most widely cited example of this approach.

The theory of Complex Adaptive Systems has also been used in health information systems research e.g. [8, 9]. McDaniel and Dribe [10] discuss the problems experienced by researchers in preventative health, who take a reductionist, mechanistic approach to continuous quality improvement in preventative health work. According to the McDaniel and Dribe's analysis the assumption that healthcare organisations are machine bureaucracies may be incorrect, and re-casting the system as a set of loosely coupled interacting components can improve understanding of how to achieve an optimum outcome. Stroebel et al. [11] suggest an assessment process to guide reflective practice, and based on this perceived need to account for the inherent complexity within the workplace. However, the evidence of the effectiveness of this approach does not yet seem to be supported by substantial evidence, perhaps due to a lack of detailed case studies in the area.

While the use of biological concepts such as ecosystems and autopoesis (self organising systems) are described and applied by Dooley [1], there is an attempt to examine the underlying role of complexity and interdependence inherent in the CAS view. However, the biological ecosystem view of organisations has been justifiably criticised for its lack of clear connection between the biological concept of species and a corresponding unit of construction in human organisations [12]. Nonetheless, there is some recognition of the potential of CAS in the human sciences, as well as in the field of health informatics. Therefore, we will attempt to apply the CAS to our case study within the domain of

the introduction of electronic nursing documentation in residential aged care facilities.

We start with the assumption that while the biological approach to analysis of organisations is informative, there are no direct correspondences. Ecosystems (a type of biological system) and organisations are both constrained by resource limitations, by the internal structure of their interacting components and by their relationship to their external environment. However the economics of the underlying resources are substantially different. While ecosystems are generally limited by nutrient availability, the resource limitations for human organisations are based on material, financial and people constraints. What is common between the two systems is that the flow of these resources is an important driver of change and homeostasis. Therefore it appears that a direct analysis of the dynamic processes that underlie resource flows should be useful in defining a more robust conceptual basis for organisational ecology.

Baranger [13] provides an excellent non-technical summary of complexity theory which is outlined in the remainder of this section. Because Baranger's disciplinary perspective is informed by theoretical physics, while his writing remains close to the mathematical underpinnings of complexity theory, his grounding in application, along with his clear teaching skills is very instructive, as it provides us with a clear logical explanation of how to link the abstract mathematics of complexity to an applied dimension.

Complex Adaptive Systems are difficult to understand because of the interaction between two fundamental components – chaos and complexity. Chaos can be a property of simple systems (i.e. systems with few parameters), and the results of chaotic models are by definition intrinsically unpredictable. Baranger states that chaos is "that part of mathematics where calculus does not apply". One of the defining features of chaos is sensitivity dependent on initial conditions (e.g. in our study it may be that the initial training approach can vary between units in small ways, but that these small differences might have dramatic consequences). Complexity is different from chaos. The human body, weather patterns, and ecosystems are all examples of complex adaptive systems where the individual constituents self-organise, and the whole is greater than the sum of its parts. Emergence (as in emergent properties) is a phenomenon stemming from complexity where the organisation and interactions at one location in a system cause changes at another separate location. A system whose configuration is capable of changing over time is called a dynamic system. A dynamic model is a mathematical model or a set of rules describing the time dependence of a point's position in space (either physical space or a more abstract idea of space). A simple example of a dynamic system is the swinging of a pendulum. Chaos has a close relationship with complexity. Complexity has the property of multiple interacting components each of which may or may not be chaotic. The network of interactions is compounded by stochasticity (probabilistically determined variation). In thermodynamics, the statistical model of probabilistic variation is described by the concept of entropy.

Entropy is an important part of any system as it helps define whether a system is closed (independent) or open (dependent on other systems). In thermodynamics, the entropy (degree of disorder) of a closed system increases over time. High entropy systems have high levels of disorder, and the components of a high entropy system are generally seen as possessing disorder whose atomic configuration are uninteresting. However, the effects of a transient increase in entropy can be interesting. A substantial outage of the electronic documentation system of our study site is a good example of a transient increase in the rate of the accumulation of entropy. This will be discussed in the results section of this paper.

One fascinating property of entropy is that even in the physical sciences, it is a constructed concept, which is used to make "reality" more manageable. The smoothing procedure used for entropy analysis defines the scale beyond which the analyst is unable or unwilling to keep track of details. Smoothing represents a self-imposed (subjective) increase in the entropy of the system – the key to understanding this procedure is to optimise the level of analysis at which it is performed – that is, how should we group the data together in order to make conclusions in an efficient way. The results section of this paper, is an attempt to do this with our preliminary data. As our data consist of individual interviews, we need to understand the nature and quality of the data we gather, and at what level we maximise its meaning. This in turn allows us to improve our understanding of the flow of resources within the organisation.

Complex Adaptive Systems' quantitative roots do not preclude its use for solving qualitative problems. For example, a quantitative problem in electronics would be to calculate the change in voltage in a lighting circuit when a change occurs. A qualitative equivalent would be to determine whether the light bulb becomes dimmer or brighter as a result of that change. It should be clear that where the number of parameters is high, or measurement is uncertain, or where a chaotic system is suspected, a qualitative solution will be more achievable than the quantitative solution.

This brief summary should illustrate that CAS as an ontology (framework to generate meaning) may help bridge the divide between positivist and post-positivist: i.e. between the perspective that there is a "true" reality versus the idea of a socially constructed reality [14]. In the search for improved understanding in social research we need to evaluate this way of looking at things in order to determine how useful it is, and to determine whether this lower level of CAS compared to the organisation as ecosystem approach is useful in providing explanations of change processes.

2. Methods

2.1. Design

Semi-structured interviews were conducted at a single 100 bed residential aged care facility in South Eastern New South Wales over a two day period in early 2009. The interview guide was developed by the second author. The themes discussed in the interviews that were found to be relevant to the complex adaptive systems approach were: communication (e.g. the role of verbal and written communication), individual opinions about the electronic documentation (e.g. is the software used well?), workplace issues (e.g. the way that the electronic documentation affects work patterns) and training issues (e.g. the quality of the training and potential improvements to the training).

2.2. Sample

The two first authors interviewed 12 nursing staff and four allied health/care staff. Interviews lasted between 10 and 40 minutes depending on the detail of the answers provided. After interviewing managers, a convenience sample was used to interview care staff due to the difficulty of getting nurses off the floor. We interviewed the nursing manager and deputy manager, three registered nurses, three enrolled nurses, three recreational activities officers, one physiotherapy assistant and four personal care workers.

2.3. Analysis

Interview notes were compiled and consolidated, and emergent themes related to the complex adaptive systems perspective were identified for further exploration in the results section below. One of the purposes of this (initial) round of interviews was to trial the interview to assess its suitability for understanding organisational change at other sites. Notes were used as a quick way of understanding the issues pertaining to change, and the coverage that the interview guide gave to these questions.

The role of complex adaptive systems in the analysis were as *sensitising concepts* [15]. These are a conceptual overlay used to bridge the divide between sociological theory and empirical evidence. They provide a lens with which to examine the data in a way that is meant to address the theoretical concerns of the research in a way that can provide a theoretical framework for analysing the data. The idea of sensitising concepts is a sociological analogy for the concepts of a priori and post-hoc analysis commonly used in quantitative work. The reason that we need to make this distinction is as follows. In quantitative studies, there are well-recognised techniques to assess reliability, validity and measurability, which have good empirical and theoretical foundations. Establishing the empirical and theoretical foundations of qualitative study is much less straightforward, for reasons relating to the philosophical scepticism school of thought (see Blumer [15] for further details). As such, sensitising concepts arising from complexity studies outlined in the introduction provide a technique with which to assess the interview notes. This allows us to explore whether the complexity approach can inform our analysis of the organisational change. If the evidence supports this approach, further rigorous analysis of the interview data using transcripts, and a more formal coding procedure is likely to inform the change processes observed during the longitudinal study.

2.4. Ethics

Ethical approval was obtained from the University of Wollongong Ethics Committee. Permission was granted for the research to be conducted at the provider organisation.

3. Results

When the introduction of technology is the primary driver of change, a "technological imperative" can occur. In such a case, managers and other organisational actors have little control over the nature of the organisational change [5]. This technological imperative fundamentally alters aspects of the process dimension in the organisation we study, because at least some of the changes come from external technological pressures. This also means that some of the drivers for organisational change in our study are outside the direct control of management. In turn, this influences the change processes which occur during implementation. Concurrent with the introduction of information technology, there have also been changes in the funding model for aged care with the implementation of the Aged Care Funding Instrument (ACFI) in March 2008, which replaced the Resident Classification Scheme (RCS), the funding model used for the previous 11 years. The interaction between the introduction of ACFI, which results in substantially simplified documentation and assessment requirements, and the electronic documentation system has resulted in significant unintended consequences which will be discussed below.

3.1. Difference between managers' and carers' perspectives – Multilevel interactions

Senior staff members stated that improved access to documentation across the organisation facilitated information flow. This is a direct result of implementing the electronic documentation system. From the perspective of the CAS theory, the documentation system reduces the rate at which entropy in the information contained in the nursing documentation accumulates over time. The positive reaction to a more consolidated set of documentation by managers appears to be directly in line with the nature of their jobs. That is, as managers have more responsibilities than care staff, and a greater need to deal with large volumes of information, they had a clearer perception of the benefits

of the electronic nursing documentation. The interviewees with a managerial position (the service managers and the registered nurses) all appreciated the improvements to reporting and data access that the electronic system provides. However, our CAS perspective also emphasises the importance of interactions across the system. For example the improvement in consolidated information access acted concurrently with a change in the regulatory environment resulting in different consequences at different levels of the organisation. The personal care workers perceived that the change of residential aged care funding model from RCS to ACFI had reduced their documentation workload. This has had two effects. Firstly, with less use of the documentation, the nursing assistant staff relied more on verbal communication; secondly a limited number of available computer terminals may also result in a reduced opportunity to access nursing records by the personal care staff, thus reducing the use of documentation for retrieval of data as well as the reduced statutory requirement for entering data. However, managers tended to find the regulatory changes made it easier for them to assess the state of their facility, and they found it easier and more reliable to lodge funding claims. While some of these staff acknowledged that this could be a good thing as it allows them more time to spend with residents, there may be a sense of disempowerment at the junior level. On the contrary, the sense of the increased empowerment at the facility management level is obvious. This is an example of the change in work practices having different effects at different levels of the organisation, with clear positive consequences for managers, but at best neutral consequences for personal care staff.

3.2. The effect of system outage – an example of potential for entropy spikes in the system

The next part of the data that we wish to examine for this paper is the effect of a technology outage. A two-week outage was caused by a networking mishap between the off-site central server and the residential aged care facility. The mishap itself was out of the control of the organisation, but a lack of disaster recovery plan evidently caused a dependence on an external telecom provider to fix the problem. The site returned to paper records during this period. This increased risk, as older documents were not available, had resulted in many staff complaints, as staff members could only rely on oral communication to pass information around. If we view the electronic documentation system as a low-entropy, low-redundancy system, and the paper based system as its higher entropy counterpoint, we can see that the risks associated with local data loss are relatively high with electronic documentation if the data are only stored off site. In our interviews we also discovered a possible extra source of entropy increase from the effects of network lag. The electronic documentation system at this facility is web based, and concurrently the computer systems are all thin clients, therefore the capacity of the network is likely to be stretched at times of high traffic. While we suspect that the direct impact of this latter type of outage is likely to be small, it is another source of increased entropy in the electronic documentation system.

3.3. Responses to personal care workers' varying involvement in implementation and continuing use – an example of emergence.

A further issue that came from the interviews, which would be categorised as emergence would be the differing responses of personal care workers to their training. There is a potential problem in managing the personal care workers' relationship to the electronic documentation system that didn't exist with the paper-based system. There has been a trend towards reducing the documentation load of personal care workers since the replacement of the RCS funding system with the Aged Care Funding Instrument in May 2008. This was roughly one year into this site's use of their electronic nursing documentation system. With the RCS, personal care workers should have had daily interaction with the electronic nursing documentation system. By comparison, the ACFI requires much less frequent recording of progress notes, as funding is based on assessment results, not on the amount of documented care activities as in the old funding model, RCS. Independent of this change, the managers at this site had decided that the checklist-based documentation (e.g. shower and bowel records) should be done on paper due to user-interface limitations of the software package. Consequently, while these workers had to use the electronic documentation on a daily basis during the first year of operation of the system, their documentation load substantially reduced in the second year.

For the care staff who either like doing documentation, or like using the computers, there was a risk of alienating them by bringing computers into their working life, then due to changes in documentation requirements, subsequently removing the responsibility. This had been perceived by the small number of affected individuals as downgrading their level of job sophistication. Subsequently in later rounds of data collection, we have observed similar patterns arising from a different situation (e.g. after the training phase, personal carers who were trained through the train-the-trainer training, then essentially stopped using the documentation system). This is suggestive of the feature of chaotic systems – self-similarity. Self-similarity is the phenomenon whereby an object has a similar appearance at different scales, for example, a coastline. As this potential disengagement of a small number of personal care workers after their involvement in training other staff to use the electronic documentation system has been observed in different situations, we suggest that this may be an example of a similar outcome arising from the operation of different contextual factors across the different stages of implementing of the system. We have also observed strategies emerging from another aged care home to attempt to promote the use of computers

as part of a broader push to encourage personal carers advance to enrolled or registered nurses. More formal recognition of this can help encourage a career path for an occupation that suffers from the lack of long-term career prospects.

Future data collection can help better understand this idea of emergence occurring through creation of new workplace resources (e.g. computer skills, and engagement with the required documentation). Understanding how these resources flow through the workplace, the opportunities generated by their effective use, and the risks posed by not using them can help formulate recommendations for management, as well as helping to explore where these kinds of emergent unintended consequences can arise.

4. Discussion and Limitations

In this paper we used the preliminary data gathered from a residential aged care facility to evaluate a complex adaptive systems approach to understanding organisational change. The primary goal of the computer based record system is to improve quality and efficiency of nursing documentation, but the structure of the workers perceptions of the system appear quite different (and would be hard to predict in advance). Our CAS ontological framework does seem attractive as a way of explaining how this potential divergence of purpose and perception occurs. Central to this approach is the idea of entropy – the degree of disorder in a system increasing over time. Thinking about a traditional paper record, and the thick dog-eared folders of patient documentation that accumulate over time, there is clearly a substantial increase in entropy at many levels – in the quality of the paper as it becomes dog-eared, and in the search-accessibility of the information as it becomes more difficult to find. We have clearly demonstrated that while the electronic system is inherently lower entropy than the paper system, there is a certain amount of fragility in it, in terms of trouble dealing with transient and longer-term outages. Having the principles underpinning CAS to guide the analytic process appears to be helpful in performing a systematic analysis of how change occurs, and what factors are most important to ensure system success. The next step for this research project is to conduct more interviews across different sites, to achieve the research objectives.

The main limitation of this article is that these interviews were conducted at a snapshot in time, whereas change is a longitudinal process. Therefore we have no way of assessing the importance of the issues identified in this paper, and the way that they may change over time. A secondary limitation is that sampling from only one nursing home means that we are yet to be able to generalise our findings to other nursing homes.

5. Conclusion

The results of this preliminary study suggest that complexity, as a framework to understand the structure of our research problem, is a useful perspective which is compatible with the broader systems view of the firm favoured in some parts of organisation studies. This makes CAS an important theoretical framework for studying organisational change. In addition to other methods used in organisation studies and occupational psychology, we hope to provide a detailed and systematic process to describe and guide change management in the introduction of health information system into health and aged care organisations.

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Appendix B

Piloting a logic-based framework for understanding organisational change process for a health IT implementation Diment, Garrety and Yu, 2011

Piloting a Logic-Based Framework for Understanding Organisational Change process for a Health IT implementation.

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Abstract. This paper describes how a method for evaluating organizational change based on the theory of logical types can be used for classifying organisational change processes to understand change after the implementation of an electronic documentation system in a residential aged care facility. In this instance we assess the organisational change reflected by care staff's perceptions of the benefits of the new documentation system at one site, at pre-implementation, and at 12 months post-implementation. The results show how a coherent view from the staff as a whole of the personal benefits, the benefits for others and the benefits for the organization create a situation of positive feedback leading to embeddedness of the documentation system into the site, and a broader appreciation of the potential capabilities of the electronic documentation system.

Keywords: Organisational Change, Nursing Informatics

1.1. Introduction

Electronic nursing documentation is a significant part of the clinical information stream across the health sector. It provides a systematic way for nurses to assess and define patient problems, record their aims, and plan, execute and evaluate their tasks. To date there have been very few studies of organisational change related to the implementation of electronic nursing documentation. The two substantial case studies we have been able to identify are both PhD theses (Swinderman, 2005; Engesmo, 2008) examining organisational issues relating to electronic nursing documentation implementation in hospital settings as participant researchers. The research presented in this paper is by contrast observational interview research – the researchers did not have the capacity to change the approach to implementation. Our aim is to use a classification method published in the literature on organisational change to better understand a specific aspect of the change - how care facility staff members' perceptions of the benefits arising from the implementation of electronic nursing documentation creates and/or reflects organizational change. Using a classification-based approach allows us to constrain the amount of information that we need to use to perform analysis, thus helping prevent information overload, which is a common problem in qualitative research (Boyatzis 1998). We have found that our approach makes it relatively easy to identify important issues within the data, and the emergent phenomena that arise from examining these issues.

Several authors have identified different levels and types of organisational change. Drawing on the work of Bartunek and Moch (1987), and Watzlawick et al. (1974), Bateson Roach and Bednar (1997) developed a typology for describing organisational change processes. A summary of their typology is reproduced in Table 1. This modified logical types framework is described in detail by Roach and Bednar (1997, pp. 683-685). The fourth column of Table 1: "actual process" needs some clarification: as with all sociological research, data are viewed through the lens of the researcher's description, as a result the descriptions at this level are materialist accounts of observed phenomena (materialism being the philosophical position that events arise from the interactions of physical entities). "Action" refers to raw description, "lineal action" to a simple step-by-step account of cause and effect, "double interaction" to the identification of feedback loops or their potential, and the "interaction patterns" to the interaction between these feedback with the environment as a whole. Under the heading 'Actual process", inferences are made about causality based on observed behaviour rather than emergent issues. The phenomena listed in the 'description' and 'classification' columns encapsulate more abstract reasoning about the observed

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processes, aimed at developing an understanding of emergent phenomena, and general principles underlying the change process being investigated.

Table 1 **Roach and Bednar's (1997) summary of the types and levels used to describe an organisational change process using the Theory of Logical Types**

Level	Classification	Type Description	Actual process
Content	Underlying assumptions and themes	Descriptions of interaction patterns	Interaction patterns
Context	Categories of feedback and relationship	Description of double interaction	Double interaction
Lineal[1] action	Causal schema	Description of lineal action	Lineal action
Simple action	Categories	Description of action	Action

1 A lineal view of causality clearly separates cause and effect and assumes that causality is a one-way process. The opposite of "lineal" is "recursive", as distinguished from the mathematical term "linear" whose opposite is "non-linear"

1.2. Research Site

As part of a broader multi-site longitudinal study, this paper focuses on a single residential aged care facility in the Illawarra region of New South Wales, Australia. The first author conducted 23 semi-structured interviews with management staff (6 interviews), registered nurses and enrolled nurses (5 interviews) and personal care workers (12 interviews). Interviews were conducted at pre-implementation of the electronic nursing documentation system (13 interviews) and at 12 months post-implementation (9 interviews). 11 further interviews were conducted at 6 months post-implementation, but these are not presented in this paper for reasons of space.

2. Methods

Interview responses were coded according to the content of answers to questions from the interview guide. In this paper, we were interested in answers to the open-ended question: "what are the benefits of the electronic documentation system", and other parts of the interview where the topic of benefits from the implementation arose. Figure 1 demonstrates the data analysis process and includes a section of original transcription notes. This approach is designed to provide a snapshot of the state of the organisation at any one time, while simultaneously providing an ability to overview the data. A synthesis report of of the summarised data at each time is presented in Table 2. This table can be considered a compact summary of the raw data after coding.

3. Results

Table 3 summarises findings pre- and post- implementation, applying Roach and Bednar's (1997) adaptation of the Theory of Logical Types. The tables should be read from the bottom right hand corner inward and upwards, as the actual/process/simple action cell contains a summary of the 'rawest' data available. The cells moving inward and upwards represent increasing levels of abstraction and interpretation. The 'metacontext' level seeks to explain the underlying phenomena based on the initial materialistic approach used in the "actual process" column.

In Table 2, the pre-implementation section describes the initial conditions at the site. The respondents appear to be focused on what the benefits were for themselves, in their job role, as well as benefits for others, and implied subsequent organizational benefits. At 12 months post-implementation, the system seems to have become embedded into the operation of the site, and some staff spoke about future benefits, and the way that they could adapt working routines to reap more positive outcomes from the system's presence in their workplace over and above the intended purpose of the documentations system, through the potential to improve staff's documentation skills and capability. This corresponds to *Actual Process*/*Simple Action* classification cell in Table 3.

Ideas about the staff's perspective of the benefits of the system – whether it's to help the organisation, or the individual worker, or both, fit with the level of *Simple Action*/*Description*. Awareness of the system's potential benefits at pre-implementation lead on to an ability to perceive those benefits on follow-up, which in turn allows staff to think about potential future benefits from the documentation system.

At *Classification* of *Simple Action* we see that the idea of the coherence of the approach to the new documentation system months. This in turn leads to, the development of a sense of ownership of the documentation system at 12 months

The remaining parts of Table 3 are somewhat easier to digest – at pre-implementation we see how the components of the organizational situation develop to provide preconditions where the operation of positive feedback loops can emerge into a reinforcing mechanism underpinned by staff's coherent view of how the system is beneficial. The mention of second order change (Watzlawick et al. 1974) arises from work we have published elsewhere (Diment et al., 2010). The distinction here is between first order change (e.g. changes to specific procedures) and second order change (e.g. changes to the nature of the tasks being done). There seems to be a realisation of the capability of IT to make strong positive changes to the workplace, at the study site, by allowing the system to become embedded into daily working life, which in turn provides the potential to realize second order change.

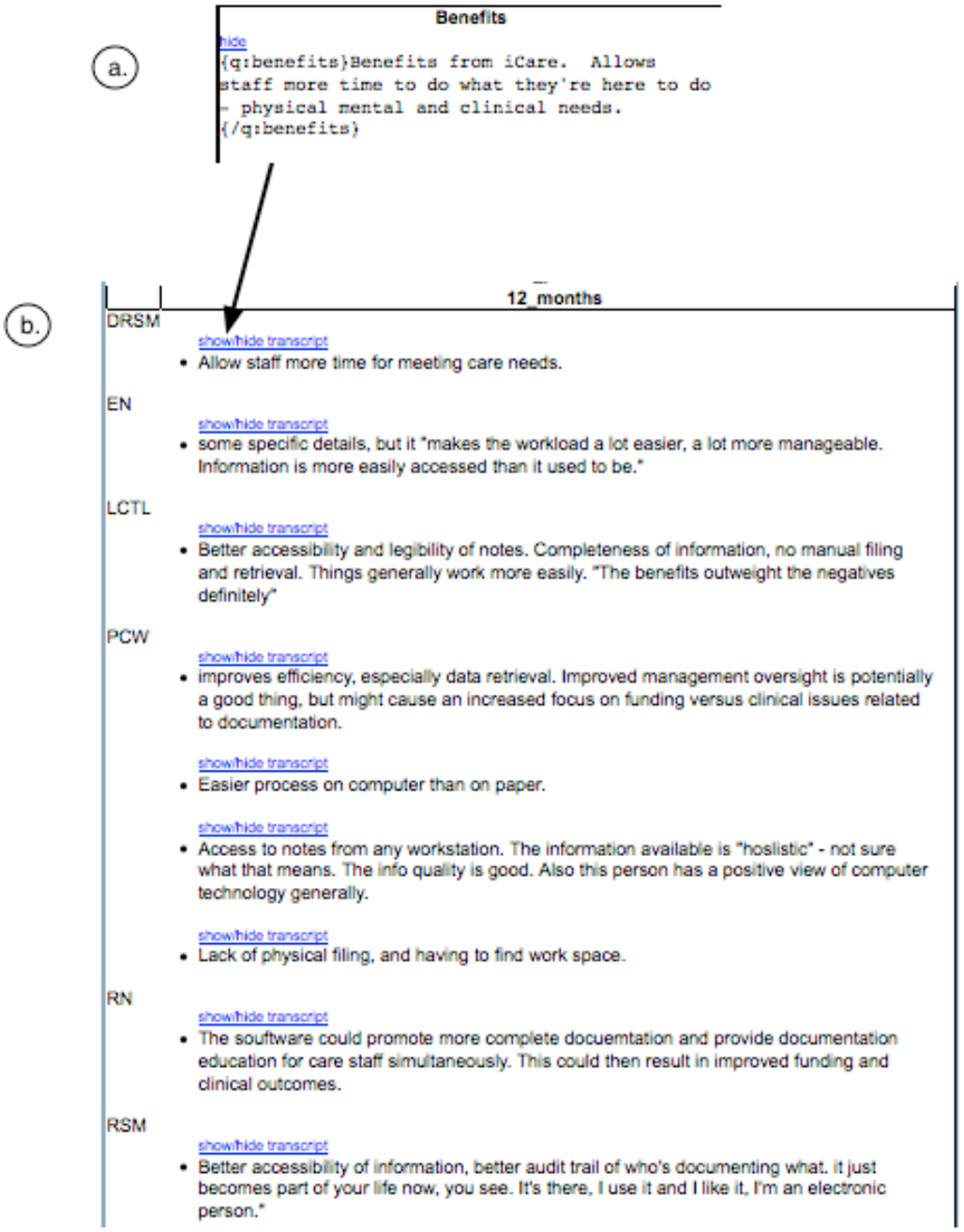

Figure 1 Example showing the data analysis process. Box A contains raw transcript notes (in this case for the deputy manager at at 12 months post-implementation. Box B contains the summary of transcript for each instance of the 'benefits of the electronic documentation system' code. The synthesis of the summaries is presented in Table 2.

Table 2 Synthesis report of coding summaries across time for “benefits” code for both sites at all stages.

	Pre-implementation	12 months post
Personal Care Workers	Decrease in chance of information loss. Quicker to do and more current documentation, Neater, lack of filing, Easier to review information, possible better career outcomes, "no reason" (positive). Decrease in double handling	Increase in efficiency, especially information retrieval. Increase in management oversight (although the downside of this is that it could cause a focus on funding rather than clinical outcomes). Easier process for documentation. Good quality information. Lack of physical filing required.
Registered & Enrolled Nurses	Discuss beneficial impacts on specific documentation tasks.	Makes the workload more manageable. Could possibly promote more complete documentation, and provide documentation for care staff via the software (with better cues to input information) resulting in better clinical and funding outcomes.
Managers	Better information flow into documentation and management reports.	Allows staff more time on care needs. Better accessibility (X2). Better legibility. More streamlined system. Better audit trail of documentation activity. “It just becomes a part of life”.

Table 3 Application of Roach and Bednar's (1997) logic based approach to understanding change from with the theory of logical types for the site at pre-implementation and 12 months post-implementation.

Pre-implementation

Levels	Types: Classification	Description	Actual Process
Metacontext	Initial focus on positive outcome	All staff are engaged in the implementation	Potential for positive feedback
Context	*Feedback*: reinforcing *Relationship*: coherence.	Personal as well as communal benefits create vision for good outcome.	Understanding of and perception of benefits interact.
Caused Action	Positive views of new system	Initial conditions favour development of positive feedback	Clear understanding of benefits leads to confident approach
Simple Action	Coherent approach of staff to moving forward with the system.	Broad awareness of benefits of the electronic documentation system for self, others and the organisation.	**PCWs**: Personal and organisational benefits. **Nurses:** Improvements for specific tasks. **Managers:** Emphasise information flow through the organisation

12 months post-implementation

Levels	Types: Classification	Description	Actual Process
Metacontext	Effective use of IT resources into the future	Engagement leads to positive outcome	Positive feedback cycle with emergent phenomenon.
Context	*Feedback*: reinforcing *Relationship*: coherence	Feedback cycle facilitates emergence of potential for second order change	Feedback cycle causes perceived efficiency gains and potential second order changes in the future.
Caused Action	Integration of system into daily working life.	Virtuous cycle of approach to ideas	Confident action leads to embedding the documentation system into daily life. In turn this may lead to creative use of system.
Simple Action	Sense of ownership of the documentation system. Awareness by staff of the relationship between their role, and others relationship with the documentation system within the organisation.	Widely perceived benefits result in positive job outcome including recognition of potential for future second order benefits	**PCWs**:. Efficiency improvements at different levels of the organisation including for themselves. **Nurses:** The existing benefits of the system could lead on to newer benefits that would generally improve carers' documentation capability. **Manager:** Identifies increase in available time for care needs, and a range of benefits applicable to managers and staff. "It just becomes a part of life".

4. Discussion

Our analysis suggests using Roach and Bednar's Logical Types technique for understanding the process of organizational change provides a useful way to understand the organizational dynamics which mediate the outcome from change. This is achieved by a combination of developing a synthesis of the behavioural attributes of the situation undergoing change. At the higher levels of classification, we are lead to both more specific conclusions from the data (e.g. that the critical mass of individual benefits leads to collective benefits at the *classification* of *caused action)*, and ultimately a positive feedback loop that helps maintain a "low friction" adaptation to the introduction of this new documentation system. Further work is required to understand whether the perceived benefits reflect objective benefits realized from the system, or whether these are presumed benefits resulting from a subjective perception only.

4.1. Conclusion

This paper illustrates an application of Roach and Bednar's (1997) use of the Theory of Logical Types to perceptions of benefits from a technological change. The theory, which is based on a mathematical approach to the logic of language, provides a coherent and systematic description of the change processes. For the present study we found that these secondary descriptions are particularly useful for making sense of observed process within the site, but that at higher levels of analysis we become concerned with the more generic presence or absence of feedback loops, and the outcome of the operation of these loops. Future research on this topic will first examine how staff perceive benefits at two other sites under the same management group where we have observed quite different positive and negative outcomes relative to the results presented in this paper. Following this we will need to make sense of how perceived benefits relate to other change issues identified in the interview data such as: frustrations, whether the documentation system is perceived to be used well, impacts on the care environment, and issues arising from the training approach used at each site. The technique outlined in this paper has the potential to provide a rigorous approach to making sense of our large corpus of qualitative data.

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Appendix C

Electronic documentation in residential aged care facilities – a review of the literature on organisational issues and early findings on initial conditions from a case study Diment, Yu and Garrety, 2010

Electronic documentation in residential aged care facilities – a review of the literature on organisational issues and early findings on initial conditions from a case study.

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Abstract

This paper discusses the theoretical rationale for an empirical study of organisational change arising from introduction of electronic nursing documentation in residential aged care facilities. The study draws on a processual view of organisational change, which is related to the theory of complex adaptive systems. First we review existing literature on electronic nursing documentation with an organisational focus to provide a context to help outline the research aims of the present study. Then we describe a method to explore the hierarchical nature of the work environment based on the sociological theory of Institutional Ethnography. Finally we use this approach to describe the differences in initial conditions between two different sites implementing the same software over the same timeframe. Results suggest that our method is sensitive enough to detect subtle but substantial differences in initial conditions between the two study sites.

Keywords

Change management, computer based nursing documentation, electronic nursing documentation, residential aged care, long-term care

INTRODUCTION

Change management issues arising from health informatics implementations are frequently highlighted in the literature as worth further investigation, but are seldom the central focus of research. This paper discusses methods and an approach to studying organisational change following the introduction of electronic nursing documentation in residential aged care facilities. It is composed of four sections. The first section outlines literature on the processual approach to change management – a well recognised approach to studying change in the mainstream organisation studies literature, but little used in the field of health informatics. The second section examines relevant literature on electronic nursing documentation with a focus on organisational issues, in order to ground this research project in the context of the field it is operating in. The third section outlines the research aims, and the methodology used to achieve these aims. The final section outlines the preliminary findings from investigating the organisational change at pre/early-implementation stage, at two different residential aged care facilities belonging to the same organisation.

CHANGE MANAGEMENT, COMPLEXITY AND THE PROCESSUAL APPROACH TO STUDYING CHANGE IN ORGANISATIONS.

While there is a substantial body of work on the theory of change management in the health informatics literature, mainly originating from Bonnie Kaplan and Nancy Lorenzi (e.g. Kaplan 1997; Lorenzi and Riley 1995), empirical studies are uncommon. A PubMed search of the term *change management* found a total of 481 papers on the topic, but only 48 of these were in the field of health informatics. These studies focus on (i) specific implementation projects where change management issues are a secondary consideration; (ii) upcoming informatics implementations, and the relevance of change management issues in planning, or (iii) theoretical concerns along the same lines as Lorenzi and Kaplan's work cited above. The search yielded only two studies with a strong change management focus, yet both lack a holistic approach, rather they focused on nurses' experience (Alexander et al. 2007), or on literature (theory) rather than the experiences of the staff within the studied organisation to understand the change management issues (Upperman et al. 2005). However, we know that other studies of change management are not detected by these search terms (e.g. Yu et al. 2010), indicating that a lack of standardised terminology in this field may inhibit the ability of practitioners to locate and apply

empirically based research findings on change management to their situations. This is compounded by the space requirements in typical academic journal articles and conference papers. According to Dawson and Buchanan (2005), change management studies are narratives about "multiple voices [and the] construction of contested realities". This can lead to "limit[ed] use of primary data", which leaves readers with "the processed outcomes of an opaque analysis".

Given this context, and lack of prior empirical work, we need to look to the wider literature in the field of organisation studies in order to understand how to describe the change management issues inherent in introducing electronic nursing documentation. One challenge we have experienced is the academic literature on the management of change is extremely large.

We have previously published work on the rationale of using complex adaptive systems to understand organisational change processes within health informatics (Diment et al. 2010). This paper examined the links between the study of complexity as a quantitative discipline with roots in mathematics and physics and the field that studies social complexity, with specific reference to early data gathered for the present study. By the time this paper was completed, we became aware of the processual approach to change management (e.g. Pettigrew 1997; Buchanan and Dawson 2007). Therefore, the relationship between the processual approach and the complexity approach will be discussed in the remainder of this section.

Van de Ven and Poole (2005) argue that the study of change has ancient roots pre-dating Socrates. It thus pre-dates the scientific method. Two different views of reality first expounded by the ancient Greek philosophers Democritus, and Heraclitus have influenced the understanding of change. Democritus theorised that reality can be represented as the relative position of stable objects whose relations change in space and time. Alternatively, Heraclitus claimed that reality can be viewed more dynamically, where the objects themselves are in flux, and do not maintain stability over time. Van de Ven and Poole use these perspectives to construct a two dimensional framework for studying organisational change. In the first dimension, the epistemology of understanding change is divided into variance and process methods. Variance methods concern the identification of underlying variables that are related to the anticipated organisational change, and examine how these variables change over time. Process methods are related to a narrative approach to understanding the experience of the different actors involved in an organisational change, and how they describe the organisational system during the course of adapting to the change within the organisation(s) under study. The second dimension is the ontology of the organisation – whether it is a discrete object which is the focus of change, or if the organisation is viewed as a set of actions (or processes) in which change is manifest or embedded leading to the idea of the organisation as a self organising system which changes over time.

Combining these two dimensions leads to four distinct but potentially complementary ways that organisational change can be studied. The variance approach combined with the organisation as a discrete entity view leads to studies dominated by statistical methods, and the use of statistical analysis with hypothetico-deductive methods. The variance epistemology combined with the organisation as process ontology leads to studies based on dynamic modelling, often using agent-based simulation. This approach is compatible with the American school of complex adaptive systems described by Maguire et al. (2006). The process approach combined with the view of organisation as a discrete entity leads to the use of narrative to describe events, and how they lead to a sequence of change within the organisation. By contrast, the process approach combined with the organisation as a dynamic entity view leads to studies where narrative produces an account of emergent properties within the situation, an approach consistent with the European school of complexity (Maguire et al. 2006). The present study is mainly focused on the organisation as process, and change as narrative. The primary reason for taking this approach is that it is very difficult to identify in advance what the important variables are in understanding the processes that underlie change emerging from the introduction of electronic documentation in our situation.

A BRIEF SURVEY OF PREVIOUS LITERATURE ON ELECTRONIC NURSING DOCUMENTATION WITH AN ORGANISATIONAL FOCUS

Nursing documentation is a significant part of the clinical information stream across the health industry. It provides a systematic framework for nursing practice encompassing assessment, definition of patient problems, recording of nursing aims, planning of nursing tasks, execution of these tasks, and evaluation of care and care planning (Ammenwerth et al. 2001). From examination of the literature on the topic of electronic nursing documentation, we performed Google scholar and PubMed searches on the terms "computer based nursing documentation" and "electronic nursing documentation". The results were screened according to the process given in Figure 1. We identified 41 papers on electronic nursing documentation in 20 subcategories (with each paper belonging to one or more subcategories). The categories most important to the present research were on system evaluation (15 publications), qualitative studies (4), and complexity (3). It is important to note that while there were eight studies on residential aged care facilities and electronic documentation, none of these focussed on organisational issues. We discuss the publications most relevant to the present study below.

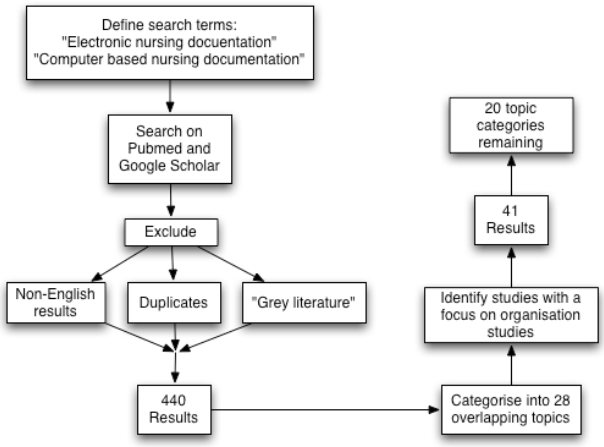

Figure 1 Process used to survey literature on electronic nursing documentation or computer-based nursing documentation

The eight papers categorised under "methodology" mainly focused on general methods for evaluation studies. Of interest to the present study is the discussion on the need for qualitative methods to complement quantitative methods for evaluation research (Ammenwerth et al. 2003).

Of the evaluation studies of electronic nursing documentation with an organisational focus, one PhD thesis evaluated the organisational effects of enhanced inter-professional communication in an intensive care unit (Collins 2009). Also in intensive care, Rikli et al. (2009) investigated issues pertaining to the management of implementation of electronic nursing documentation from the perspective of quality management and the clinical microsystems approach (Nelson et al. 2007). This is a valid approach for implementation management, but is of limited relevance to the change management perspective of the present study as it has a much more clinical focus. Intensive care seems to be a popular environment in which to study electronic nursing documentation, perhaps because of its clinical intensity, high level nursing work, and requirement for high quality documentation.

A further evaluation of organisational issues examined the acceptance of electronic nursing documentation in a rural hospital in the USA (Whittaker et al. 2009). The study drew on specific behavioural issues as enumerated by the Staggers and Parks Nurse-Computer Interaction Framework to examine barriers and facilitators to the acceptance of electronic nursing documentation in the hospital setting (Staggers and Parks 1993). Further investigation of this framework is needed to determine its suitability for evaluating behavioural and situational aspects of change management issues related to the implementation of electronic nursing documentation. However it does not appear that this framework can adequately explain the complexity of change management embedded in the highly connected multilevel interactions inherent in the healthcare industry. This is because the framework emphasises change at the level of management and outcome, but does not consider the intricate, often political aspects of the human and organisational issues which are at the centre of this process (Dawson and Buchanan 2005).

From very early in our project (described below), we identified the importance of complexity for explaining organisational change within the health setting (Diment et al. 2010). Our observation from an initial overview of the literature was that the vocabulary of complex adaptive systems was quite common within the health informatics evaluation literature (e.g. terms like emergence, interaction, wicked problems, the highly interactive inter- and intra- organisational consequences of change). However, there have been few explicit attempts to link these concepts to the implementation of IT in healthcare. Given this, and the small number of publications on organisation issues in electronic nursing documentation, it is unsurprising that only three publications on complexity were identified. Aside from our own work, the two remaining publications on organisational complexity pertaining to implementation of electronic nursing documentation are PhD theses.

Engesmo's (2008) thesis reported on organisational changes affecting nurses following the introduction of electronic health records in Norwegian hospitals. This project has some perspectives in common with the present study. The primary sociological perspective used is symbolic interactionism (Manis and Meltzer 1972). This theory is often used in qualitative empirical work investigating the interactive nature of social life. A social consensus (intersubjective) view of the construction of reality is important in this type of research, because the researchers are the instrument used for conducting the research, collecting and interpreting data. Engesmo also uses complexity theory in his research in order to account for the "patterns [which] emerge unpredictably from interaction embedded within a micro- and macro- level environment" (Engesmo 2008 p. iii.) An important difference between Engesmo's study and the present one is that his research was participative action research,

and, as a participant, he had input into the implementation and management of the electronic documentation system.

There were two main empirical components of Engesmo's study, the change of practice of nursing handover caused by the implementation of the electronic system, and secondly the introduction of electronic nursing care plans. The change in practice from exclusively verbal handover (informing staff of what happened during the previous shift) to "silent handover" comprising two-thirds of the allotted time where nurses just read patient notes, and one-third verbal handover. The verbal time was generally for information not documented due to being "subjective or uncertain". The non-professional nurses were not required for parts of the verbal handover process, and so were available on the floor for longer. It was found that the change from the exclusively verbal shift handover resulted in reduced handover time, increased relevance, and better control of confidential data. The successful implementation of this change in practice improved nursing documentation, and the more efficient dissemination of workplace knowledge.

The second change in practice was the move to electronic nurse care plans (ENCP). This implementation was more problematic. With no guidance from senior management, but an implied managerial desire for an immediate use of ENCP, this implementation resulted in substantial user resistance. Allowing the individual working unit managers to stage the implementation of ENCP ameliorated this problem somewhat, but did impair Engesmo's ability to draw conclusions about the change management issues surrounding ENCP in the timeframe available for his research.

The second PhD thesis was by Todd Swinderman (2005). Again this focused on nursing documentation in hospitals, specifically on the management issues pertaining to the implementation of an electronic documentation system from the perspective of IT professionals. Swinderman as a nurse administrator was, the same as Engesmo, engaged in participative research. In this case, Swinderman was a member of the technical implementation team. The focus of the research was thus on discerning the needs of implementers for understanding hospital nurses requirements in order to provide software that meets their needs. While the approach and findings of this research are outside the scope of the present study, which is an observational study of an already deployed electronic nursing documentation, the methodological justification of the thesis is of interest. As with Engesmo (2008), Swinderman appeals to complexity theories, although with a greater emphasis on the nursing literature's use of chaos theory as a metaphor. By contrast, Engesmo's citations on complexity theory were more generic works from organisation studies. Likewise, while Engesmo appeals to symbolic interactionism to account for the intersubjectivity inherent in the change management process, Swinderman appeals to phenomenology, a related theory. Swinderman places greater store on complexity theory rather than more sociological theories, as his methodology combines quantitative and qualitative data (mixed methods). He suggests that complexity, with its roots in mathematics and physics, can provide a bridge between the two approaches.

While both Engesmo and Silverman cover similar areas of research, using similar theoretical frameworks, the citations used to justify the approach have very little overlap. Although this may indicate a difference in perspective of the research projects, it is also possible that due to the very large amount of literature from sociology and social psychology that deals with the issues of intersubjectivity, similar conclusions can be reached from different sources. Given this large volume of literature, and the challenge of having to constrain it to a manageable reading list, the difference in sources from the two authors, while not surprising, is worth noting, in order to explore the criteria for a 'good enough' research methodology for this kind of research. Aside from the focus on residential aged care facilities rather than hospitals, the key difference between Engesmo's and Silverman's research, and the present study is that our research is observational, and not action research. This is because in our case the researchers are external to the organisation being investigated and are not involved in the decision making process. Therefore the aims and methodology will be somewhat different. These are detailed in the next sections of this paper.

RESEARCH AIMS

With respect to the present study, we take the view that residential aged care facilities and management groups should be seen as dynamic organisations, responding to changes in their environment such as new technologies and regulations, and changing staff and resident demographics, among other factors. As this process-based view is central to the present study, and as process can be understood by developing a narrative through the analysis of longitudinal interview data, it is important to clarify what is meant by the term narrative.

Buchannan and Dawson (2007) claim that the development and use of narratives in organisational change research must account for their polyvocal properties, which emerge from the mainly interview-based data which are the most common data collected in this kind of research. As a result, narrative does not represent a linear story as in the literary sense, but is a "multi-story process" guided by the researcher to shape an explanation of events to provide an account of change. This account is sensitive to the needs of the different actors in the

situation being researched. This is very important, and central to the purpose of this study because generating this polyvocal narrative is not an end in itself, but provides a means of answering broader research questions. Once these narrative accounts have been developed, we can use them to answer more specific research questions relating to *resources, strategies*, *process* and actors, namely how resources, strategies and processes were mobilised to effect change, and the outcomes of those mobilisations. Resources, strategies and processes are central concerns of organisations adapting to their environment (Miles et al. 1978), while actors also play a central role in shaping the relationship of the organisation with the environment. We hope that this structure for understanding change can situate the analysis of research data in a way which facilitates a systematic approach and accounts for the conformation of both the internal and external environment. The results presented later in this paper show how accounting for these factors can be used to help structure our findings.

Our Approach

In the field of health informatics, there is a conflict between a positivist, experimental view of health informatics, and a less constrained sociological view, which considers the importance of experience and the socially constructed intersubjective nature of social life. The differences in approach are well summarised by Kaplan (2001). Intersubjectivity refers to "the common sense shared meanings constructed by people and their interactions with each other and used as an everyday resource to interpret the meaning of elements of social and cultural life" (Seale 2004 p. 508). The majority of health informatics evaluations (the present study being type of qualitative evaluation itself) do not take this approach. Instead, they are dominated by quantitative work, with 80% of evaluations surveyed in a systematic literature review between 1982 and 2002 being primarily quantitative studies. Only 5% of studies were exclusively qualitative in focus, while the rest either used mixed methodology or did not specify their methods (Ammenwerth and de Keizer 2005). Since the publication of this inventory, the authors have continued to add articles to the database (available at http://evaldb.umit.at) with the number of exclusively qualitative studies increasing to 18%, and mixed methods increasing to 29% between 2003 and 2009. While quantitative work is useful in situations where relatively large samples are required and available, they cannot capture the intricacies and subtleties of lived experience for which qualitative methods are much more appropriate. This latter approach is required for understanding the trajectory of change being researched in this paper.

The most common method for qualitative research in organisation studies and health sociology is Grounded Theory (Glaser and Strauss 1967), a systematic data-driven approach, which is a reversal of the usual scientific method. Instead of generating hypotheses at the beginning of the research process, transcript and other data are coded to identify emergent themes. The themes are then used to refine and test the generated hypotheses via an iterative process of *continuous comparison*. However, examination of the use of grounded theory in health informatics research suggests that while it seems well suited to micro-social situations with a limited range of actors (e,g. Irurita, 1996; Embi et al., 2004; Hendy et al., 2007), the risk of information overload is high (Miles 1979). This makes the study of rich macro-sociological comparisons, such as that required in the present study, difficult. The dominance of the grounded theory and statistical approaches to data analysis in many areas of management-focused social science research has resulted in a range of methodological issues. In the organisation studies literature in general there is a strong tendency for qualitative methods to be insufficiently detailed to allow a paper's readership to understand the procedures used to analyse the data. This problem has become more widespread in recent years; in part due to the way that much qualitative data analysis software encourages a formulaic analysis (Jones and Diment 2010). Cautions about a procedural checklist approach based on the epistemology of quantitative research are a recurring theme in the literature (e.g. Barbour 2001).

The focus of our research on change is broad, encompassing the whole organisation environment (discussed at the beginning of this section). In addition to the healthcare and administrative effects of the documentation system, we need to know how managers and trainers influenced the implementation of the system, how their views of the role and capability of the documentation system affected the implementation, which in turn could have affected the non-managerial staff's ability and willingness to use it. This multi-layered situation creates a state of affairs in which an understanding of organisational complexity and the hierarchical nature of the situation becomes important (Anderson et al. 2003; Begun et al. 2003; Maguire et al. 2006). The remainder of this section discusses a methodology based on the sociological technique, Institutional Ethnography that can account for this embedded complexity while reducing the risk of information overload.

Institutional ethnography (Campbell 1998, 2001, 2004; Smith 2001) is a sociological theory / method package that attempts to describe the social organisation of knowledge using a materialist empirical approach (Rankin 2008, p. 4). Its core ontological position is that social life can be understood as "ruling relations" that are organised through texts or text-mediated processes (DeVault and McCoy 2006). Clearly the focus of the present study on nursing documentation is well suited to this approach. Ruling relations refers to the embeddedness of individuals within hierarchies, which mediate their relationships within social life. Institutional ethnography has been used widely in research in the sociology of nursing (e.g. Campbell 2001; Rankin 2008; Vukic and Keddy

2002). There are also a small number of studies which use the approach in health informatics research (Moehr et al. 2001; Poland et al. 2005). As this approach takes account of the research subjects' embeddedness in social hierarchy, and how the hierarchy influences the change, it fits well with the complexity theory and processual approaches discussed previously. It provides a framework in which to understand the organisational change processes as having simultaneously bottom-up and top-down features as per the systems view of change management (Cao et al. 2004), and therefore is a good candidate methodology for the present study.

Data analysis for institutional ethnography research tends to be more flexible than those prescribed by grounded theory. Rather than the typical approach of coding data into emergent themes and using this to generate hypotheses and relationships, Institutional Ethnography takes a simpler approach to coding, tending to avoid this formal analytic strategy. Instead, parts of interview transcripts are indexed according to topic (DeVault and McCoy 2006, pps. 769-771). As a result, the substantial risks of information overload that are inherent in more immersive coding procedures are much reduced.

Once our interviews were transcribed, they were processed using a three stage coding procedure. First they were indexed by the topic (broadly based on the interview guide), the job title of the respondent (reflecting ruling relations), and the site. Second, each coded section of text was summarised in the researcher's own words (in order to reduce the effects of the highly variable way that different individuals express themselves). Finally, a summary of each interview topic was written in order to highlight the different views expressed by job title and location. This comparative approach provides us with the substance for our polyvocal narrative. It is important to note that the summaries were closely linked to the original unprocessed transcripts and audio files, so while the data were quite heavily processed, they remained connected to their original raw forms. Retaining information within content-based topics rather than less well defined themes keeps the research focused on the different processes that occur during the longitudinal study, and allows for a description of the process of change over time, clearly describing differences between the sites.

PRELIMINARY FINDINGS FROM THE CASE STUDY

Two residential aged care facilities under the same management group, one regional and one rural, were the study sites for this investigation during the first half of 2009. Both were at approximately the same stage of implementing electronic nursing documentation when the research commenced, with training completed. However, staff at the regional site had not yet begun using the electronic documentation system, while the rural site staff had been using the system for exception reporting of progress notes for about one week. Twenty-six semi-structured interviews were conducted (14 in the regional site, and 12 in the rural site). The interviewer (the first author) spent two days at each site through the morning and afternoon shifts recruiting study participants and conducting interviews that lasted between 10 and 40 minutes. The longer interviews tended to be with managers, or with carers selected for "train the trainer" training, and/or more skilled computer users with sufficient information technology experience to allow them to discuss the introduction of the electronic documentation system more extensively.

A breakdown of the demographics of the research participants is given in Table 1. Note that sampling participants in "train the trainer" training was approximately equal in the regional and rural sites, but that only one member of staff at the rural site provided any training to the rest of the care team members (due in part to staff turnover, and in part as implementation occurred concurrently with accreditation which caused corresponding human resource shortages), while almost all of the trainers at the regional site did this. No urban site is available in our study sample. From discussion with those in the aged care industry, we would expect staff turnover and the proportion of care staff from non-English speaking backgrounds to be higher in urban sites, due to the low pay and difficult working conditions in residential aged care homes. Because the demographics of the regional and rural sites are very similar in terms of staff age, turnover and ethnicity, these details are not reported in this paper.

Table 1 Total number of interviews by job title at each site, and total number of interviewees who received "train the trainer" training at each site.

Site	(Deputy) Managers	Low Care Manager	Registered Nurses	Enrolled Nurses	Recreation Officers	Personal Carers	Total
Total number of interviewees							
Regional	2	1	2	1	1	7	14
Rural	1	1	2	1	1	6	12
Number of interview subjects who attended "train the trainer" (out of 10 total trained at each site)							
Regional	1	0	0	1	0	2	4/10
Rural	1	1	1*	0	0	2	5/10†

*One registered nurse was a trainer for the same software product at the previous organisation she worked for.
† Only one personal care worker among this group ended up providing hands-on training.

Our comparative approach to coding helps highlight the different attitudes and experiences of floor staff and managers to the change from paper to electronic documentation. Because the documentation software was closely modelled on the pre-existing physical paper documentation, the floor staff tended to regard the differences between the paper and electronic systems, as simple (occasionally inconvenient but generally positive) differences in the way data entry was performed, and not a more fundamental difference in the *process* of documenting their care work. By contrast the managers were aware of a much greater potential for fundamental changes to their work due the improved retrievability of data in the documentation system, and ability to have the documentation system communicate directly with the software claiming funding from government.

The differences between training regimes at the two sites, with many peer trainers available at the regional site, and only one available at the rural site, suggests the action of a bottom-up effect in establishing high levels of staff awareness at the regional site, which was not present at the rural site. It's difficult to determine to what extent this difference was due to the differences in the availability of human *resources* at each site or staff capability (especially with computer skills and communication skills). Were these factors similar at both sites, but just more effectively utilised at the regional site? Did the inconvenient timing of "train the trainer" training at the rural site compound a pre-existing lack of human resources, or were the resources available but not utilised? Further research is required to answer this question, as the answer will reflect initial conditions as well as the subsequent outcomes.

The management's awareness of the potential benefits of improved flow of information seemed much lower at the rural site than the regional site, and this seemed to have a top down effect in that staff's awareness of the capability of the software in turn seemed limited. The rural site management seemed to have a less *strategic* view of how to introduce and encourage the adoption of the new system. Instead the rural site management were focused on immediate issues surrounding the implementation, while not considering the future possibliities of what could be achieved with the electronic system that could never have been achieved using the paper system.

Finding the explicit evidence for this is quite difficult, and perceiving improvements in the documentation process could easily be interpreted as a purely management-driven phenomenon, in that the most obvious statements about the improvements in capability of the electronic documentation system are from the management at both sites. While the regional site's manager acknowledged the improvements that the software brings to the funding application process, s/he then went on to discuss other features that the software provides, such as the ability to audit the quality of staff's documentation, and consequently being able to use this as an informal appraisal process, to help drive an improvement of the documentation of the site through leadership. By comparison, the interview extracts from the rural site do not go beyond the improved retrieveability of the documentation for funding purposes. Data about benefits of the electronic documentation system illustrate the combination of top down versus bottom up effects quite well – a representative comment from a personal care worker at the rural site that the benefits are for "the managers to flick up a resident['s notes], I think it will be great for them".

Detailed accounts of individual benefits of the electronic documentation system were not forthcoming at the rural site, while staff at all levels in the urban site had positive comments about benefits for them as individuals who use the electronic documentation system, particularly concerning the increased efficiency with filing, the potential for documentation to be more up to date, and more consistently formatted.

Assessing the initial conditions at each site provides us with a comprehensive assessment of the starting differences between the two sites. The differences between initial conditions manifest themselves as differences in training approach and resources, and the site management's strategic view of what can be achieved with the electronic system. We have performed follow-up interviews at 6 months post-implementation, yet to be fully analysed, and will conduct further interviews at 12 and 24 months post-implementation. This will allow us to track the consequences of these different initial conditions over time. Do the two sites eventually converge to a similar outcome, or do the big differences in initial conditions cause divergence of outcomes over time? Or to put it another way, how do the differing initial conditions affect the trajectory represented by the "classic change curve" in Figure 2 – do the two sites converge to a similar outcome, or does the difference in a starting point influence the trajectory towards a divergence over time?

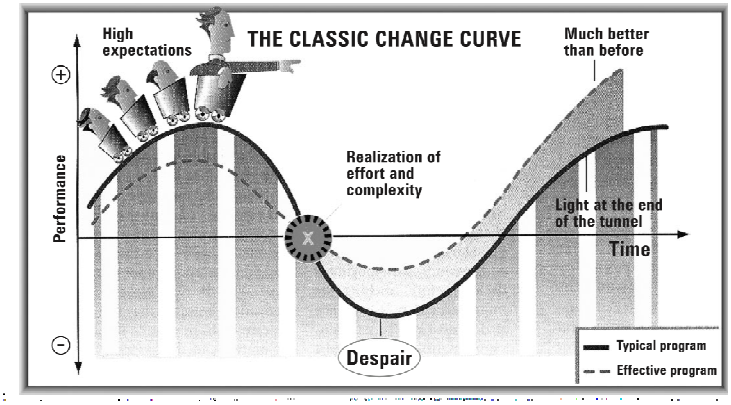

Figure 2 The classic change curve, reproduced from Elrod and Tippett (2002)

CONCLUSION

This paper has reviewed previous approaches in the literature on researching organisational change both in nursing informatics, and more generally in health informatics. The existing literature in health informatics, organisational studies, and general social science has been brought together to find an appropriate methodology for investigating organisational change as observational rather than participant researchers, at the level of the whole organisation

Our findings relate to the processual view of organisational change in that our findings are influenced by analysis at all levels of the organisation – we examine the embeddedness of the change – "studying processes across a number of levels of analysis" (Pettigrew 1997) and we provide the framework for future examination of "temporal interconnectedness" (ibid). Our approach is also consistent with the complexity view of organisational change in that we are setting the frame to determine how non-linear causal relationships are influenced by interconnected by feedback loops which result in amplification, extinguishment or homeostasis (Maguire et.al 2006). This requires a holistic view as these interconnections can span different parts of the organisational structure. In turn, this is reflected by the hierarchical view taken by our analysis.

The processual view concerns the progress of change over time, wheras the focus of this paper is to discuss our approach supported by a case study examining the indital conditions. Consequently only a few finding have ben reported in this paper. However our results to date suggest that the approach is able to detect differences in initial conditions, which may have divergent influences on the future trajectory of the changes at the two study sites. These initial conditions can be seen as emergent properties – the whole of the situation in the organisation being greater than the sum of the parts, which initiates the process that begins the trajectory of change. The parameters of strategies, resources and processes interacting with the actors, together mediate a response sensitive to the different starting conditions within each study site. Our preliminary results suggest that we have devised a methodological strategy sensitive enough to detect the differences between the sites at the early stage of this research. We have a good strategy and approach for following the change processes in each organisation over a longitudinal study.

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Appendix D

A prototype open source toolkit for comprehensive, flexible and extendable computer assisted qualitative data analysis Diment, 2010

A prototype open source toolkit for comprehensive, flexible and extendable computer assisted qualitative data analysis

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Abstract

While commercial tools for computer assisted qualitative data analysis (CAQDAS) are widespread, there are no comprehensively featured open source tools for this task. Development of such a set of tools has the potential to increase accessibility of qualitative data analysis software for researchers, and provide an open platform for fostering innovation. This paper describes a simple computer readable/human writable prototype for CAQDAS. The bulk of the paper focuses on the data structures required for storage of documents, for code and retrieve data storage processes, and the use of open source programmers tools for storage of the complete history of the data analysis project. In the final part of the paper we describe three examples of how this prototype open platform could be used to provide innovative processes to assist with qualitative data analysis.

Keywords

Computer assisted qualitative data analysis, open source software, software prototype

INTRODUCTION

Open source software – computer programs that can be freely redistributed on the condition that the source code must also be provided by anyone using the software - has a long history of use in research. One such recent major example in quantitative analysis has been the R project (Ihaka and Gentleman 1996), which is an open source programming language for statistical analysis. Within the last 5 years, R has moved from being a relatively obscure open source project to the main way of providing reference implementations for novel statistical techniques. Along the way it has been widely adopted in industry, especially in the areas of biotechnology, finance and IT (F. Leisch, Core R developer, personal communication). That it is open source can be extremely important as it provides researchers with a level playing field in terms of the availability of software resources, a standardised set of tools to foster innovation in the field, and thus a standardised framework for replicable and verifiable methodology. No such equivalent exists for qualitative research. This has the potential to restrict progress in aspects of qualitative analysis.

The well-known computer assisted qualitative data analysis (CAQDAS) programs are exclusively commercial, closed source off the shelf software packages. To the best of our knowledge all use closed proprietary file formats, and interoperability between different products is mostly unavailable, and/or discouraged. As a result of this, changing qualitative analysis packages is hard, and export from one package to another package, or just to home grown tools will almost certainly result in loss of data and/or metadata. This barrier to use of alternative software causes significant inertia, reduces researcher freedoms, and may cause reduced detail of reporting of methodology (Jones and Diment 2010). One possible exception to this is the XML export facility provided by Atlas.ti, which can apparently export a project's complete data to an XML format. However, as no other qualitative package supports this format yet, this interoperability is limited. Additionally, for technical reasons relating to the XML specification, XML will never be a good format that is simultaneously human and computer readable for qualitative data analysis. The reason that this is important is described in more detail in this paper.

Open source software for some tasks in qualitative data analysis do exist (Qualitative Innovations in CAQDAS 2010), but none of these projects are of sufficiently ambitious scale to be able to replace existing commercial qualitative data analysis tools. Perhaps one of the reasons for this is that the open source projects either focus on a graphical user interface for code and retrieve processes, and/or a single specialised aspect of other parts of qualitative analysis work. However, the real problem that needs to be solved in order to provide comprehensive infrastructure for open source qualitative data analysis tools is an appropriate file format, and associated data structures. The purpose of this paper is to briefly describe a prototype software architecture for developing qualitative data analysis tools.

A SIMPLE ARCHITECTURE

A primary consideration is that while in the quantitative disciplines, high levels of computer literacy, and experience with computer programming are quite widespread. In the qualitative disciplines this is not the case, and so developing tools that intuitively make sense for non-computer programmers is important. Given this important constraint there are two main considerations for developing qualitative data analysis software. Firstly we need to consider the data structures required. Fortunately the operating system already contains much of the infrastructure required for this.

File system based storage of the the qualitative data corpus

If we think about qualitative data analysis software as a means to query a corpus of hierarchically organised data files, the metadata concerning much of the files themselves can be stored in the file system through a structure of directories. From this, it is possible to store metadata about the file's position in the analysis in the directory names, or file names, although this may not be sufficient for some types of qualitative data analysis, so discussion of storage of metadata for individual files is elsewhere in this discussion. The use of special operating system files (i.e. symbolic links in Unix based systems – which includes the Macintosh, and newer versions of Windows) can then be used to provide multiple different views of the same data – reflecting different hierarchical organisation. For the research project within which our open source qualitative analysis software is being prototyped, we interview care staff at different nursing homes longitudinally. Using this file system based storage scheme the interview transcripts end up in a hierarchy of directories as shown in Figure 1.

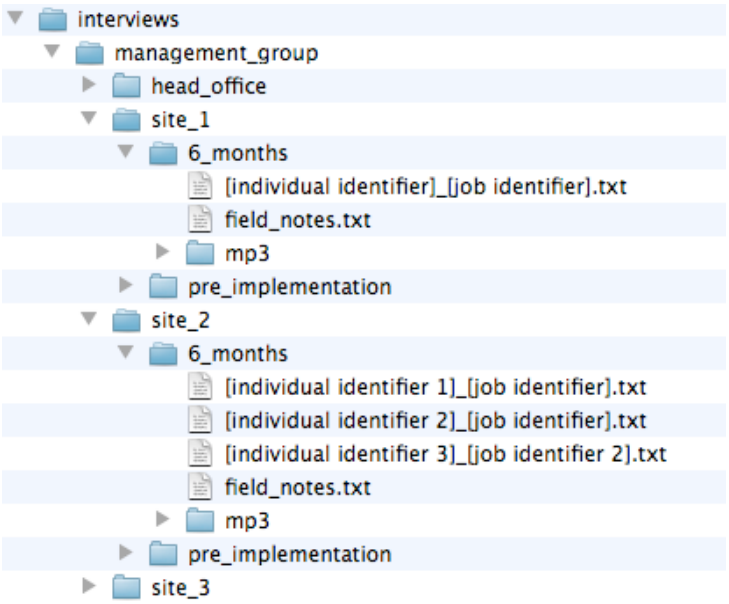

Figure 1 Example of metadata stored in directory hierarchy. Note that that for the prototype that this solution does not generalise to different schemas for analysis, but that solving this problem should be relatively simple by careful consideration of a formal specification.

Sometimes, it is not sufficient to be able to store all metadata in the directory and file names. For example, our interview transcripts are stored in the file system along with the original mp3 file containing the audio data. The location of the MP3 file is stored in a special (human writeable and computer readable) data structure block inside the transcript file. Arbitrary textual data can also be stored in this data structure block, although we have not yet found it necessary to do this for our data analysis. We have the strong opinion that wherever possible, transcript data should be stored in plain text, as this format is substantially easier to write software tools for, and integrates easily with the version control based lab book system which we describe further on in this paper. However, most media file formats contain their own metadata, which can be interrogated by a variety of software tools (e.g. ID3 tags for MP3 files – this could be used to point the mp3 file to the location of its transcript on the file system for example).

A minimal file format for code and retrieve

While XML (eXtensible Markup Language) has been proposed as a possible approach to providing an open file format for qualitative data analysis it has two significant limitations for the use case of coded qualitative data. Firstly, XML parsing tools can require substantial technical knowledge, and therefore are likely beyond the capability of many qualitative researchers (given that we are focusing on tools that can operate transparently,

either using automated or manual based processes). Secondly, the specification of XML requires that tags cannot overlap. Therefore, given a coding scheme represented by XML tags, the following is problematic:

```
<code name="greeting"> Hi Jane, I hope you didn't get too <code
name="weather">cold today </code>, as the weather was pretty
poor</code>
```

There are two issues here. Firstly from the human readability perspective, it is not possible to quickly identify which closing tag block corresponds to which starting code block – a problem that will increase exponentially with more complicated coding, and a longer transcript. Secondly as the two `code` tags overlap, this is not valid XML. To be valid XML, the coded chunk of text would have to look something like as follows:

```
<code name="greeting"> Hi Jane, I hope you didn't get too </code><code
name="weather"><code name="greeting" id="continuation">cold today
</code></code><code name="weather" id="continuation">, as the weather
was pretty poor</code>
```

The complexity this introduces as far as parsing the data goes is unacceptable based on our initial premise that the tools should be simple and easy to use. It also makes the manual coding of data very difficult and error prone. However, by using SGML (Standardised General Markup Language – a superset of XML), which does allow for overlapping tags, we can avoid this complexity. An example of the (currently informally specified) SGML format that we use for coding is as follows:

```
{code:greeting} Hi Jane, I hope you didn't get too {code:weather}
cold today {/code:greeting}, as the weather was pretty
poor{/code:weather}
```

This is far simpler both for reading and for computer based parsing, than either the valid or invalid XML. We programmed a small Emacs (text editor) macro, which prompts the end user for the code to apply to the chunk of selected text in the editor window. Replicating this in other text editor environments (or even in a web browser to provide a graphical interface) is a reasonably simple task. This makes for extremely simple coding, and the list of codes can be displayed in another editor window as an *aide memoire*. The tools for parsing, searching and retrieving this kind of data are also simple. We have written prototype code, available under an open source software licence (Diment 2009a). This code contains test data, and an automated test suite, which tests expected output from known input, and so guarantees the specified behaviour. A prototype web application designed to run locally on the user's desktop coupled to this library is also available (Diment 2009b), and has been used for the author's PhD research for searching, retrieving and visualising the results form data analysis. As with the other tools described in this paper, there are some instances of close coupling of the code structure with the research that prompted the development of this tool, and so solutions are not yet generic for use with other projects. However, great care has been taken with the design of the tools that modifying them to create a generic solution should be reasonably straightforward. It's important to note that the underlying information stored in the file format could be represented in XML without data loss. This could be useful in that a wider range of parsing tools could be used to interrogate the data. However the trade off would be significantly increased complexity, and a representation of the data that was no longer be human readable or writable without considerable effort and technical skill.

TOOLS FOR TRANSCRIBING AND NOTE-TAKING

For reasons relating to the fact that dealing with plain text rather than binary file formats is much easier from a programming perspective, our strong preference is to store all processed data as plain text. Therefore in the development of the prototype, we used the Emacs text editor, and a software library to extend the editors behaviour to provide a number of functions to assist with transcribing (Foth 2001). Although the library only works with audio files at present, extending it to deal with audiovisual materials will be straightforward. The functions it provides are automated inserting of timestamps during transcribing, so that the transcript is closely coupled to the correct position in the media file, semi-automatic insertion of speaker attribution, ability to move the "play head" of the media file around through user-defined key presses, and finally providing the ability to seek to the correct location in the media file based on the current position of the cursor. We use the open source media player mplayer for playback (Mplayer development team 2010). The solution as currently implemented is not ideal for non-programmers at present, although we expect that with the continued development of the HTML5 specification (W3C 2010), a web based interface providing this functionality will be easy to implement as the standard matures. It's also worth noting that the emerging HTML5 standard contains constructs for displaying and structuring transcripts.

TRACKING A PROJECT'S HISTORY

The final piece of the puzzle, and something that is neglected by all other qualitative analysis software is the facility to record the complete history of a project. This is roughly the equivalent for a qualitative researcher as the lab book is for an experimental scientist. Fortunately with our emphasis on text based infrastructure, and ready appropriation of open source programmer's tools, we can use a version control utilities already in use by open source software developers. Without going into excessive detail, this allows us to record the complete history of a project, including transcription, the coding process, and correction of any errors along the way. This provides a comprehensive audit trail, which allows the researchers themselves understand the evolution of their thought processes during data analysis, as well as a transparent record, which can be used by collaborators to understand the process underlying the analysis of the data. This is generally achieved by browsing the differences between one revision and others (the technical term is a *diff*) either by examining line-by-line, character by character, word by word differences, or with a small amount of programming, coded chunk by coded chunk. As well as this, due to the roots of version control software in the open source community, they are designed to be used for collaboration. Therefore, multiple people can work on the same project (and even the same document) at the same time. Concurrent changes from different users can be merged together, and policies and procedures can be put in place for dealing with conflicts (i.e. two or more researchers making edits to the same portion of the same document). Merging tools in plain-text based version control software are far better developed, and more mature than in commercial word processing packages such as Microsoft Word. This kind of software is also more flexible than the kind of revision control achieved by wiki software. Clearly this approach has much potential to inform and clarify the collaborative process. The software we have chosen for this task in our project is called "git" (Torvalds and Hamano 2005), which as it is used by a substantial number of open source projects with a large contributor base, which can number in the thousands. Because of this, we are confident that this set of utilities can scale to the largest practical collaboration base for a qualitative data analysis project. The down-side of all version control software is that they do not gracefully handle binary data, although substantial progress is being made in this area at present, which is yet another reason to strongly encourage the exclusive use of plain text data formats for textual data. Extendable web based interfaces to git do exist, so we are confident that with further development of this tool, some of the complexity of working with programmers version control tools can be hidden from the end user where desirable.

THE IMPORTANCE OF DOCUMENT STRUCTURE

For historical reasons, the commonest format for handling text for qualitative researchers is the Microsoft word document format (doc) or it's close cousin rich text format (rtf). Apart from being binary file formats, which do not suit the needs of our project at all well, as explained previously, there are another two problems. Firstly, both formats lack a formal specification (i.e. output varies subtly based on what version of the program was used to produce the documdent, or even which version of a specific program was used!), and so writing tools to parse information about the document and its structure are difficult, although this problem can be reduced by using proprietary tools containing trade secrets. Taking this route adds complexity and is against the philosophy of our approach.

While the use of plain text only adds structure by implied contract (i.e. our use of automatic tools in transcribing to add timestamps and speaker identity, and the use of a data structure header for metadata), this is easily extended to use an extremely widespread and richly featured structured document format – HTML, in universal use for the World Wide Web. Extending our text-based prototype to HTML allows us to use the same conventions as web programmers to provide a strictly structured, and easily parsed and document format. This in turn allows for linking processed data (e.g. memos and other analytic notes) to the original transcript, either using server-side programming tools (the approach mainly used to date), or client side tools. We have developed a data visualisation tool using client-side programming in HTML and JavaScript which can be distributed as a stand alone single document. We have used for comparing different groups within our data set. This allows us to closely couple our processed data – memos and other notes – with the raw transcript data by exploiting internal hyperlinks in a strictly structured document format. We are also able to use colour, and other visual aids to the text to improve the readability of the document, and to make its structure clear. As with many aspects of this projects in its current state the internal logic is fairly closely coupled to the data analysis being performed, but as with the other examples of this, care has been taken with the design to ensure that a more general solution will be reasonably straightforward to develop.

AN ENVIRONMENT THAT FOSTERS INNOVATION.

A significant problem with the proprietary tools in use for qualitative data analysis, is that extracting processed data to use in other automatic or manual procedures outside the software are not straightforward, partly due to either missing or poorly realised interoperability facilities, and/or due to the inherent complexity of the document export format. Having a data-centric, modular view of the way that qualitative analysis software should work, and maintaining a philosophical approach which stresses the importance that the raw data file

format should be readable, and edited both manually and using computer assisted tools means that the tools which we have developed are not subject to this problem. The use of loosely coupled modular tools lends itself well to the computing concept of a pipe (where the input of one program can be used as the output of another program) means that adding new tools to assist with data analysis should be straightforward, and easily merged back into our tools. Two obvious examples of this would be integration with the Wordnet lexical database (Fellbaum 1998) to assist with finding standardised terminology within a corpus of qualitative data, or use of the OpenCalais web service (Thomson Reuters 2010) to provide high quality named entity recognition within the corpus. One intriguing possibility which we have experimented with, with some success is use of a technique to estimate the emotional content of text (Dodds and Danforth 2009) in order to assess the emotional valence and strength of different parts of transcripts in a way that can help provide a comparative lens to different research participants, or defined groups of research participants. Being able to apply innovative procedures like this is difficult with existing commercial qualitative data analysis tools due to the lack of well-developed data import/export capabilities. By keeping the file format constrained, simultaneously readable/writable by both human and computer means that development of these tools is straightforward, and easily integrated back into the tag and retrieve system outlined previously.

DISCUSSION AND CONCLUSION

This paper describes the need for an open source toolkit for qualitative data analysis in much the same way that the R statistical software provides an open platform for innovation in quantitative research. The comparative software design limitations for qualitative software compared to quantitative software seem to be generally related to the computer literacy of the audience who use the software, which for qualitative researchers seems lower than for quantitative researchers. As a result we describe an architecture designed to have sufficient simplicity for such an audience, while simultaneously trying to maintain the flexibility required for the diverse needs of qualitative researchers. A side effect of devising a flexible open data format is that this also provides a platform for innovative for computer assisted qualitative research.

One of the primary motivations for developing these tools is that the author has high level computer skills, and is a moderately competent computer programmer, mainly through some involvement in the open source community (e.g. Diment and Trout 2009). One of the criteria and constraints for developing these tools parallel to his PhD research is that the development time should not exceed the time that it would take to learn one of the commercial qualitative data analysis packages in enough detail to be useful. This had the substantial advantage that it allowed the author to leverage his existing skills with processing text in the Unix environment to make many procedures (e.g. error correction) which are cumbersome in graphical user interface environments much more straightforward by the use of standard tools available by default in Unix systems. Having said that, great care has been made to ensure that the system will work well with Unix (both Linux and Mac OS X) and Windows operating systems.

While in conversation with other qualitative researchers, it has sometimes been difficult to persuade them of the need for a comprehensive set of open source tools for qualitative data analysis. However demonstration of some of the features (especially some of the visualisations) have resulted in comments about the apparent user-friendliness of parts of the prototype system, as well as the way that very close attention has been paid to keeping processed data very closely coupled with the raw transcripts and audio files. We hope that this project, can in the long term help provide researchers in qualitative data analysis with a set of tools that can help provide transparency, analytic rigour and a platform for developing new analytic techniques.

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Appendix E

The CAQDA Paradox: the divergence between research method and analytical tool Jones and Diment, 2010

1. Introduction

There is wide ranging, long held, debate on the assessment of quality on qualitative methods. This is well positioned by Rolfe (2006, 304):

> [T]his issue can be broadly divided into three positions: those writers who wish qualitative research to be judged according to the same criteria as quantitative research; those who believe that a different set of criteria is required; and those who question the appropriateness of any predetermined criteria for judging qualitative research. Of the three positions, the second appears to have generated most debate …

While acknowledging this incertitude, this paper looks at the problem of quality in qualitative research from a fresh perspective. Regardless of what position people take, and indeed, whether there should be assessment criteria for qualitative research, we believe, if a researcher states they are using a particular method, then they should demonstrate with a relevant degree of rigour, that they are in fact using that method for research and analysis. This extends to all types of qualitative research, and in the case of CAQDA, to the tool a person uses for analysis. A tool should not be a proxy for a valid method of analysis. Rather, the tool is merely an extension of the analyst, designed to augment analysis. Researchers must treat their research and analysis according to their prescribed methodology. We posit that this is not always the case. Consequently, we have developed two hypotheses which guide the discussion and analysis in this paper.

1. The primary focus of this paper is to gauge the integrity of research by authors who use CAQDA for analysis. Our claim is that many of these researchers are not using a clear or well articulated methodology for research or analysis. Instead, they are offering the analytical tool as a means of analysis/research, and not appropriately explaining what they have actually done. Our primary hypothesis is:

   H_1: a significantly large proportion of qualitative researchers using CAQDA use their tool as a proxy for actual methods of research or analysis.

2. The second hypothesis proposes that, in a large proportion of cases, researchers do not adequately explain how they are using their CAQDA tool and/or what value the tools adds to analysis. Instead, researchers tend to proceed on the assumption that readers are fluent in the tools they use and the benefits or deficits its use provides. Our secondary hypothesis is:

   H_2: a significantly large percentage of qualitative researchers do not explain, with sufficient rigor, the application and use of their CAQDA tool.

The premise upon which we will make this measurement will be to examine the espoused method of research and analysis, and using content analysis (Krippendorff, 2004) and constant comparison (Glaser & Strauss, 1967), assessing 325 related articles to deduce whether a valid method is used, and to what degree of rigour it is applied.

This research is important because it questions the assumptions and practices of qualitative researchers. It provides a reality check on the quality of research among our peers, and it flags what we allege are the diminishing standards among some researchers, and the consequential effect this has on the reputation of the field and supporting journals. Seale (1999b) supports this proposition and observes a decline in adhesion to philosophical foundations by researchers who trade quality for efficiency. This, if left unchecked, will lead to a spiralling decline in methodological detail resulting in poor research practice, which will ultimately have a debilitating effect on the whole qualitative paradigm.

A second element of the paper will follow this analysis. This section will attempt to outline an initial solution to the problem identified here by endeavouring to remove the bond between the research method and the CAQDA software. Using this tool, tentatively named "TranscriptMiner" , researchers are able to embrace a tool which is a-methodological.

2. Studies on the quality of qualitative analysis

There are many books and articles which espouse how a researcher should conduct qualitative research. Many of these detail, to differing degrees, how a researcher may validate their qualitative approach to attain a level of quality. However, there are few studies which inquire about the actual quality of work conducted, and where flaws are likely to be found. This gap in the literature is even more profound in business and management research.

In a review of several frameworks for assurance of quality, Walsh and Downe (2006, 113) found that researchers must be both specific and explicit with regard to the data they wish to collect and the method they use:

> [S]pecific methods have evolved with different emphases that are particularly suited to particular spheres of investigation. If the culture of an environment is being explored, then ethnography is most appropriate as method. If the focus is on an in-depth exploration of subjective experience, then phenomenology would be suitable. If 'talk' or dialogue is under scrutiny, then discourse analysis is indicated. Where the nature of the particular method used is not recognised by the researchers, there is a risk of a certain fuzziness that may extend to data collection methods and analysis.

Looking at analysis alone and given the variety and divergence of methods available, it is sometimes difficult to document every step (Walsh & Downe, 2006). Qualitative researchers deserve and enjoy liberal amounts of latitude in expressing their research. However, there are some areas of explanation which we find are generic to most methods and should be provided to assure readers a level of confidence. The following is a list of measures we have used to qualify the studies in this research. These measures for confidence of analysis are derived from a number of studies: (Rolfe, 2006; Seale, 1999a, 1999b; Sitzia, 1999; Walsh & Downe, 2006).

1. How explicit is the research approach (e.g. thematic distillation, constant comparative method, grounded theory)?

   This criterion assesses the extent of discussion and justification which addresses the choice and use of method. It is expected that authors cite leading

theorists, present discussion couched in a language appropriate for the method, and make specific reference to how the method is used in their research. For example, researchers using grounded theory would be expected to cite Glaser, or Strauss or Charmaz, etc. They would be expected to at least mention method-specific terms like selective coding, or axial coding, etc.

2. How and why is CAQDA used?

   When analytical tools are used there needs to be a justification of why they are used and an explanation of how the tool has been implemented. It is not sufficient to merely state that a tool is used. For example a researcher who has made use of NVivo would be expected to discuss how coding was conducted. Researchers may also discuss how memos were used. Modelling may also be included.

3. How clearly are coding systems developed and explained? How systematically are these used?

   Invariably, qualitative researchers collect and compare data using a prescribed unit of analysis and a defined schema for coding and comparison. While the systems adopted will be specific to their actual methodology, there will be a system. This system must be made explicit, and discussion must be presented which aims to assure readers of rigid and consistent application of the analytical approach.

4. How well discussed and defined are findings of themes, concepts and categories? Is there sufficient evidence provided to support their conception?

   Themes, concepts and categories (*research elements*) can be arrived at internally following an emergent process from the data analysis, or they can be applied externally, from some previous conceptualisation, usually from literature, a previous study, or the research instrument. Either of these positions is valid. However, readers cannot be expected to take for granted that this is how these research elements have arrived, and that they are in fact representative of the data under analysis. Authors must present their logic, and if possible, show an audit trail which illustrates how the research elements have been conceived and how representative they are.

5. To what degree is anecdotal support of research findings included?

   The problem with authors providing anecdotal support is that the inclusion of quotes from research consumes word count, and this is not always affordable with journal publication. However, such an inclusion provides factual substantiation of the research data and the connection between analytical abstraction and empirical evidence. Papers which provide only high level conceptualisation risk losing contact with their data, and as such, forcing the reader to make their own assumptions about the supposed connection. Good empirically driven papers will have a balanced approach to abstraction and empirical substantiation.

These are included here as the bare minimum that researchers must address. There are many other factors that should also be discussed, for example: Is the research method

congruent with the data being collected and the situation under study? How does the researcher ensure that context is retained as a fundamental component of the coding? Does the author provide a balanced perspective? What sampling strategy was adopted? These many additional permutations have not been included here. Instead, we have focused on the core criteria. The imposition of which we feel does not decrease the methodological flexibility that is characteristic of qualitative analysis.

It is acknowledged that authors are often made to compromise content on the basis of word count. In such cases, communication of results may take a higher priority than justifying a method. So perhaps the baton of responsibility must pass from the author to the journal editors who must ensure that on balance both results and findings, and method are explicated in sufficient detail and quality (Walsh & Downe, 2006).

3. Method

Three databases – 1) Proquest Central, 2) Proquest Asian Business and Reference, and 3) Proquest European Business – were queried to search for all business and management related articles. The selection of articles which were relevant to this research was filtered according to two lists. Table 1 shows the business keywords that were used, and Table 2 shows the list of CAQDA tools that were sought. Some of these tools were removed from the list of search terms due to their similarity to common words with different meanings. They were removed from the search because of the spurious results they affected. These omitted tools are listed in Table 3.

Administration
Organisation/Organization
Leadership
Management
Business

Table 1 – Business keywords used for search terms.

NVivo	NUD.IST	Atlas.ti
MaxQDA	Qualrus	Transana
askSam	Folio Views	MetaDesign
AQUAD	MECA	Inspiration
SemNet	HyperRESEARCH	QCA
GOFER	Metamorph	Orbis
Sonar Professional	The Text Collector	WordCruncher
ZyINDEX	COMPUTER MAX	QUALPRO
HyperQual2	Kwalitan	Leximancer

Table 2 – Names of CAQDA tools which were used for search terms.

The Ethnograph
Tabletop
ETHNO
Martin

Table 3 – CAQDA tools which were excluded from the search.

Each database was searched according to the resulting combination of search criteria. For example: Proquest Central + Administration + NVivo. The combination of these unique search terms resulted in 405 individual searches. The accumulated results from all searches yielded 587 articles. This number was further reduced after reading, and manually screening, each article to ensure a fit with the research schema. The final number of articles that were included in this study was 325.

Each article was then read and analysed to quantify its quality, using a 5-point Likert scale to rank the paper based on the five criteria discussed above and according to the two research hypotheses. For example if a method is merely motioned it would be allotted a score of 1. If all of the criteria were discussed and the method properly introduced and explained, then a score of 5 would be allocated. Where the method or analysis included quantitative methods, only those aspects relating to qualitative were evaluated.

The following section characterises the data and presents findings relevant to the hypotheses.

4. Findings and Discussion

Characteristics of the data

The journal articles were drawn from the years 2005 to 2009, with the majority published in 2007 and 2008. Table 4 details the breakdown.

Year	Count	%
2005	55	17%
2006	58	18%
2007	97	30%
2008	92	28%
2009	23	7%
	325	100%

Table 4 – Breakdown of Journal Articles.

In total there were 722 authors. The majority of these came from the UK (27%), followed by the USA (26%) and Australia/New Zealand (21%). The complete breakdown is graphed in Figure 1.

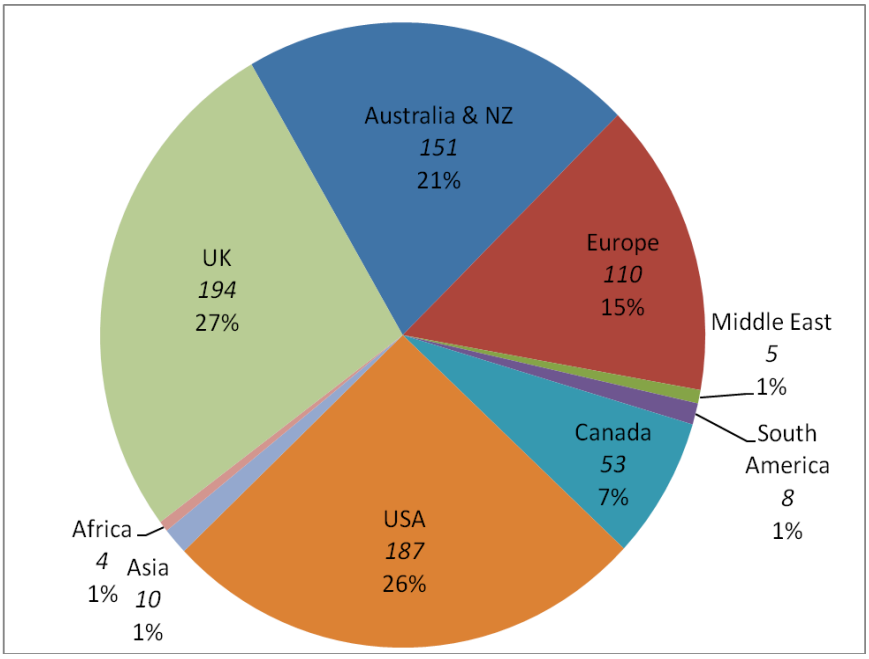

Figure 1 – Breakdown by Author Location (Country/Region *Count* percentage).

The methods of analysis used in these papers were predominantly case study (28%) and grounded theory (20%). However, a shockingly large proportion of papers (21%) did not explicitly state a method, or provide sufficient description of their method for the reader to deduce a valid research approach for the paper. The analytical software of choice by the majority of authors was NVivo or Nudist with 72% of the paper count. Tables 5 and 6 show these breakdown statistics. Table 7 provides a cross-tabulation between the software and the method of research showing what software is most commonly associated with which method. From this analysis it seems Atlas.ti may be more popular for use with grounded theory and NVivo more popular for case study analysis.

Case Study	Content Analysis	Ethno-graphy	Grounded Theory	Phenom-enology	Thematic analysis	Unclear	Other
28%	7%	6%	20%	3%	5%	21%	9%

Table 5 – Research Methods used.

Atlas.ti	HyperRESEARCH	Leximancer	MaxQDA	NVivo/Nudist	Other
20%	2%	2%	2%	70%	2%

Table 6 – CAQDA Software used.

	Case Study	Content Analysis	Ethno-graphy	Grounded Theory	Phenom-enology	Thematic analysis	
Atlas.ti	8.6%	0.9%	4.1%	10.0%	1.4%	1.8%	**26.8%**
HyperRESEARCH	-	1.4%	-	0.5%	-	-	**1.8%**
Leximancer	0.9%	-	-	-	0.5%	-	**1.4%**
MaxQDA	0.9%	-	0.5%	0.5%	-	-	**1.8%**
Nudist	7.7%	3.2%	0.5%	4.1%	-	1.4%	**16.8%**
NVivo	22.3%	5.9%	3.6%	12.3%	3.2%	4.1%	**51.4%**
	40.5%	**11.4%**	**8.6%**	**27.3%**	**5.0%**	**7.3%**	**100%**

Table 7 – A Cross Tabulation showing the correlation between research method and CAQDA software. *'Unclear' methods and 'Other' categories of method and CAQDA have been omitted.*

Hypothesis 1 – do researchers use CAQDA as a proxy for actual methods of research?
Analysis finds that in this sample of 325 articles, researchers do not provide sufficient explanation of the research method they have used. In total, 236 papers (73%) were allocated a Likert score of 1 or 2, meaning that the author(s) had not sufficiently explained their method of research or analysis. Only 50 articles (15%) were considered to have appropriately addressed this element of the paper.

Hypothesis 2 – do researchers rigorously explain their use of the CAQDA tool?
Similarly, analysis on the second hypothesis finds that researchers do not provide sufficient explanation of how they use their CAQDA tool, or what value it adds to the research and analysis. In total, 234 papers (72%) scored a Likert value of only 1 or 2. Only a minority of papers in the sample 37 (11%) actually discussed how their tool worked and its various nuances.

Discussion
Most papers typically pass off their poor methodological discussion using general terms and language. For example the following extracts illustrate popular approaches used to veil a valid discussion on method. In each case, these extracts comprise the entire methodological discussion. *In order to conceal the identity of these authors these extracts have not been referenced, however a list of references can be provided by the primary author on request.*

1. *The QSR NUD*IST Vivo (NVivo) software package was used to manage the data. Using NVivo, transcripts were coded according to themes and analysed using a constant comparison approach (Glaser 1992). Phenomena were labelled and categories were discovered which were then analysed in terms of their properties and dimensions. From these concepts theory is able to be built (Strauss & Corbin 1990). Code notes were written from the open coding procedure; these were our initial thoughts about important themes, and possible relationships and issues that seemed important to the participants.*

   The adoption of a grounded theory approach is implicit in this statement, and is drawn from references to Glaser and Strauss & Corbin. However, the actual process of analysis is vague. A person unfamiliar with grounded theory would

not understand the term ‘constant comparison’ and there is no clear connection between *theory building* and *Strauss & Corbin*, nor how theory is actually built. In this case it is not improbable that an unweary reader could be led to believe that NVivo is the method of analysis.

2. *Using atlas.ti software, the interviews were catalogued, cleansed, and qualitatively analysed. The data confirmed ...*
   The project managers told stories about their knowledge and learning experiences in projects. From these, it was possible to extract common concepts and solutions that they deployed and to aggregate these into principles for practitioners.

   The reader is left making many assumptions here. Interview data, it seems, undergoes a form of thematic analysis through the intervention of Atlas.ti. Just how this transformation happens is not clear from this description of method. In this case (1) the research approach is not explicit, (2) there is no mention of why and how Atlas.ti is used, (3) there is no explanation of a coding system, and (4) while themes are somewhat discussed elsewhere in the paper, no explanation of arrival is given.

3. *Initial analysis of the data into rudimentary categorizations was performed using Atlas.ti software. The research results were then further distilled through subsequent discussions among members of the research team, re-examination of the transcript data and reorganization of the initial theme categories. Thematic development was a fluid process, involving ongoing reflection on the contents of the transcripts, inclusion of narrative accounts directly from the interview transcripts, and the search for deeper meanings and linkages of the emergent themes in light of the researchers’ own ... backgrounds and other relevant literature.*

   Here too, the CAQDA software seems to do all of the work. The method, which is espoused to be thematic analysis, is barely referred to. A person who is familiar with the method is likely to infer the information needed to understand what is going on. However, we as authors must be prepared to appeal to a wider audience. We should not affect a language which works to alienate our readership. This is a problem realised with this article.

In the next section of the paper we introduce a potential solution to this problem. This tool, provisionally named TranscriptMiner provides a means to achieve an a-methodological approach to qualitative research. Use of TranscriptMiner would remove the presumption of CAQDA having an embedded methodology, just as the use of specific general purpose statistical software packages are not presumed to particular quantitative methods.

5. Why do we need a comprehensive open source qualitative data analysis tool?

A major development in the world of quantitative analysis in recent years has been the development of the R project (Ihaka & Gentleman, 1996), which is an open source

programming language for statistics. Within the last 5 years, R has moved from being a relatively obscure open source project to the main way of providing reference implementations for novel statistical techniques. Along the way it has been widely adopted in industry, especially in the areas of biotechnology and finance (F. Leisch, Core R developer, personal communication). The open source nature (where the software can be freely redistributed on the condition that the source code must be provided by anyone redistributing the software) of this project is extremely important as it provides researchers with a level playing field, and a standardised approach to foster innovation, and provide a standardised framework for replicable and verifiable methodology.

At present there is no equivalent open source project which aims to provide an equivalent facility for qualitative data analysis despite some small scale or specialised software interface for code and retrieve analysis or content analysis (see http://en.wikipedia.org/wiki/Computer_Assisted_Qualitative_Data_Analysis_Software for the very short list). However none of these projects are of sufficiently ambitious scale to be able to replace or enhance existing commercial qualitative data analysis tools. Perhaps one of the reasons for this is that the open source projects either focus on a graphical user interface for code and retrieve processes and/or focusing on a single specialised aspect of the work. However, the real problem that needs to be solved in order to provide comprehensive infrastructure for open source qualitative data analysis tools is providing an appropriate file format, and the associated data structures to provide a framework for interrogating the project's corpus.

The well known qualitative data analysis software packages are exclusively commercial, closed source off the shelf software packages. To the best of our knowledge almost all packages use closed proprietary file formats, and interoperability between different packages is mostly unavailable, and/or discouraged. As a result of this, changing qualitative analysis packages is hard, and export from one package to another package, or just to home grown tools will almost certainly result in data loss. This barrier to use of alternative software causes significant inertia, reduces researcher freedoms, and may cause reduced detail of reporting of methodology as detailed in the first part of this paper. One possible exception to this is the XML export facility provided by Atlas.ti which claims that a project's complete data can be exported to XML. However, as no other qualitative package supports this format yet, this interoperability is limited. Additionally, for technical reasons relating to the XML specification (especially the need for balanced tags), XML will never be a good file format for simultaneously human and computer readable file formats for qualitative data analysis. The reason that this is important is described below.

A simple minimalist architecture

Rather than XML, we propose that a combination of SGML (Standardised General Markup Language – a superset of XML), standard text based configuration files, and use of the standard features of a modern operating system's file system. Together, these can provide the basis for the data structures needed for computer assisted qualitative data analysis.

The goal of the development of a standard set of tools for computer assisted qualitative data analysis should be to provide a human readable and writable file format that can be used at the level of a reasonably computer literate researcher. This

enables the user interface portion of the tools to be taken care of by existing tools, and the developers can then concentrate exclusively on the logic required for data entry and data retrieval. The requirement for a minimal level of computer literacy is especially important for this cohort, as there is little or no history of computer programming skills being widespread among qualitative researchers. We describe the structure developed to date which provides this simple structure for qualitative data analysis.

The SGML based file format is quite simple. Codes are placed in curly brackets as follows:

```
{optional_label:code_name}Text being coded is here
{/optional_label:code_name}
```

A more concrete example is in this fictional conversation between Fred Flintstone and Barney Rubble:

```
Fred:

{q:how}Hi Barney, how are you?

Barney:

I'm pretty good Fred{/q:how}, {t:activity}have you been to work
today at all? {/t:activity}
```

Where the "q:" prefix indicates a question, and the "t:" prefix indicates a theme. It's then a simple matter to key each theme and question in a text file. For example the questions text file might look like this:

```
Smalltalk {q:smalltalk}

    How are you? {q:how}

    What do you think of the weather? {q:weather}

Bigger questions {q:big}

    What is the meaning of life? {q:life}

    What is the airspeed velocity of an unladen swallow?
{q:swallow}
```

A corresponding themes file would key the themes in a separate file. This is clearly a very light weight representation of the kind of code tree structures found in commercial qualitative data analysis software. By using a programmer's text editor, we can have the relevant coding files on screen at the same time as the transcript file, and record keyboard macros which mean that coding can be done extremely quickly while minimising the risk of error.

As well as this coding, we need to be able to specify searches and retrieve from them. To this end the second author has developed a set of programmer's libraries, and a

web application to provide document search and code retrieval functionality. The software library is available from http://github.com/singingfish/Text-TranscriptMiner, and the web based search interface is available from http://github.com/singingfish/Text-TranscriptMiner-Web. The programming language Perl has been chosen for this work due to its flexibility, very large library support and particular strengths with text processing. The programmer's library is backed by automated tests which mean that as well as ensuring the reliability of the software with text data, the same testing framework, which is based on receiving expected output from known input, new tests can be written to describe particular research procedures.

The web application is intended to run on the local machine, not to be accessible over the internet. The point of the search and retrieve process is to be able to provide a unique "address" for each chunk of coded document. This along with the use of version control (see below) provides a convenient mechanism for relating memos to specific parts of the document. With the search function being web based, it's quite possible to use links to ensure that memos for example are closely bound to the specific parts of the documents that they arise from. Clearly when we are looking at the links between documents, HTML in combination with Javascript provides us with a highly structured, well understood document model that provides much pre-existing technology which can be used to help understand the content and structure of a set of documents.

While the library and the web application are in very early stages of development, they illustrate that simple, powerful robust and replicable processes can be implemented very easily to provide an open source framework for qualitative data analysis. As is usual with software projects, the production of quality code is a smaller problem compared to writing end user documentation, and making it simple for external contributors.

Tracking a project's history.

The final piece of the puzzle, and something that is neglected by all other qualitative analysis is the facility to record the history of a project. Fortunately with our emphasis on text based infrastructure, and ready appropriation of programmer's tools, we can use the version control utilities already in use by open source software developers. Without going into detail, this allows us to record the complete history of a project, including transcription, the coding process, and correction of any errors along the way. This provides an audit trail which allows the researcher to understand themselves the evolution of their thought processes during data analysis, as well as a transparent record which can be used by collaborators to understand the process underlying the analysis of the data. This is generally achieved by browsing the differences between one revision and others (the technical term is a *diff*) either examining line by line or word by word differences. As well as this, due to the roots of version control software in the open source community they are designed to be used for the purposes of collaboration, so multiple people can work on the same project (and even the same document) at the same time. Concurrent changes from different users can be merged together, and policies and procedures can be put in place for dealing with conflicts (i.e. two or more researchers making edits to the same portion of the same document). Clearly this approach has much potential to inform and clarify the collaborative process.

Multimedia

We have avoided discussing qualitative analysis of multimedia resources. There are two reasons for this. Firstly, the vast majority of qualitative research summarise aspects of these kinds of sources with text, and the ability to use a good programmers text editor as transcription software by playing embedded audio or video, while providing semi-automatic attribution of speakers and time stamps in the document is very simple. Similarly clickable image maps provide the ability to annotate images, and there is a range of pre-existing open source solutions to perform this kind of task inside the web browser. Therefore the multimedia capabilities of qualitative data analysis software are a secondary consideration. The larger part of the problem is to provide a common-sense structure for data management, which can be simultaneously be used by both humans and researchers.

6. Conclusion

Qualitative analysis runs the risk of losing its position as a valid paradigm of research if researchers don't take care to be rigorous when applying and explaining their research methods, especially when CAQDA are used. The latter case is particularly important because researchers often fall into the trap of using the CAQDA tool as a proxy for actual embedded means of analysis. The research conducted here finds that almost as many as 75% of CAQDA based papers do not explain or apply research methods rigorously enough, and instead rely upon the reader to make metal leaps and assumptions to deduce a method of research and analysis.

As a solution to the problems presented here, we offer TranscriptMiner as a potential analytical framework. One of the benefits of this approach, which is appropriate here, is that TranscriptMiner is a-methodological, and as such cannot create a situation where the software can become a proxy for an actual research method.

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